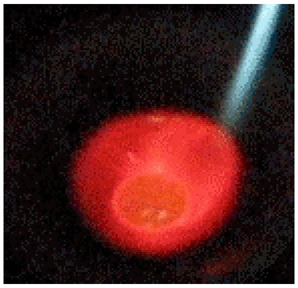

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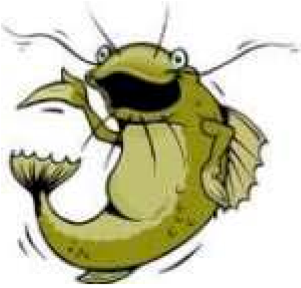
GOLD SILVER PRO



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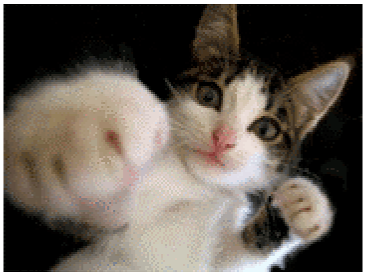

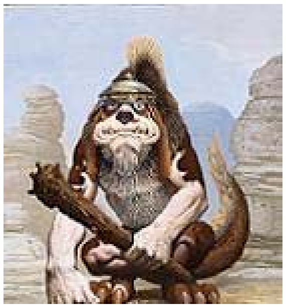

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General Reaction List

All,

There seems to be a lot of confusion on the various acid mixtures used in the different reactions. I've put together this quick list of reaction mixes. I know it's incomplete so I'll be adding to this list soon.

Here's a quick reaction list:

☠

1. AR= Aqua Regia = 1 part 70% Nitric Acid, 3 parts Muriatic Acid (some guys use 4 parts muriatic). Used to dissolve high karat gold, gold powder, gold foils, dissolves Platinum when hot. Excess nitric must be neutralized with Urea to pH 1 +/- 0.4, then drop gold with SMB.

    - Hoke states 4 fluid ounces HCl + 1 fluid ounce HNO3 dissolves 1 troy ounce gold. This is equivalent to 31 mL HCl + 8 mL HNO3 per gram of gold.

2. AR Recipie 2= Poor Man's AR = 8 oz Sodium Nitrate, 480 ml water, 960 ml Muriatic Acid plus heat. Used to dissolve high karat gold, gold powder, gold foils, dissolves Platinum when hot. Excess nitric must be neutralized with Urea to pH 1 +/- 0.4, then drop gold with SMB.

    - The above mentioned recipie makes enough AR to dissolve 160 gm Pins or 32 oz of ceramic cpus.

3. HCl-Cl= Clorox Method = 4 Parts Muriatic, 1 Part Clorox (added in small increments). Used to dissolve gold foils and powder. Drop gold with SMB, NO urea needed.

4. AP= Acid Peroxide = 2 Parts Muriatic Acid, 1 Part 3% Hydrogen Peroxide. Dissolves base metals, slowly dissolves gold when heated. If gold is present drop with SMB, NO urea needed.

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5. Dilute HNO3=Dilute Nitric Acid= 1 part water, 1 part 70% Nitirc Acid. Used to inquart, dissolve base metals, dissolves palladium, and dissolves silver. Silver nitrate will stain skin blue which turns black in sunlight. Skin remains black for nearly 1 week.

    - Hoke states 4-6 pounds of concentrated nitric acid dissolves 1 pound of base metals. 5 pounds of 70% nitric, 1.41 sp.gr. is 1610 mL =~ 0.425 gallons.

6. H2SO4= Sulfuric Acid = 1 cup 96%+ Sulfuric, 1/8 tsp glycerin. Used as electrolyte in electrolytic cell along with a small amount of glycerin. Effective on medium to large gold plated items. With specially designed anodes and cathodes large batches of smaller plated items can be processed. Not used for Gold filled or karat jewelry.

    - Use until acid is saturated with black powder typically 12-24 hours of operation. Sink any floating black powder, let settle overnight, pour off bulk of acid for reuse, and dilute remaining acid with 4 parts water.

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Stripping cell for plated items.

Gold Powder recovered from stripping cell

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7. HCl= Muriatic Acid = 31.45% Hydrochloric Acid. Used in the crockpot method and for general cleanup of gold foils and powders. Dissolves base metals. Also used in making stannous chloride gold testing solution.

8. SMB= Sodium Meta Bisulfite plus water=28.3 Grams Sodium Meta Bisulfite, 240 ml H_2O. Used to drop gold from gold bearing solutions.

    - Add 65 grams to 100 ml water for saturated solution. Add to pregnant solution until stannous chloride test on solution is negative for gold.

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9. $AuCl_3$= Auric Chloride= Term used to describe gold dissolved into solution. Typically imparts a golden yellow color to solutions. Stains skin and other organics purple.

10. $SnCl_2$= Stannous Chloride= Used to test solutions for precious metals. Made by dissolving metallic tin in hot muriatic acid. Loses strength when stored. **Stannous Chloride**, $SnCl_2.2H_2O$.—The crystals are best purchased. If kept dry and free from air they are fairly permanent. A solution is made by dissolving 20 grams in 10 c.c. of hydrochloric acid and diluting to 1 litre. The solution is not permanent. It is a strong reducing agent, and is chiefly used in solution for this purpose.

Positive color test as follows:

Purple/Black color is Gold in solution, the darker the spot the more Gold.

Yellow/Brown color is Palladium in solution, the darker the spot the more Palladium.

Light/Dark Rose color is Platinum in solution, the darker the spot the more Platinum.

11. $(NH_2)_2CO$= Urea= 8 oz Urea, 480 mL Water. Used to neutralize excess nitric acid in AR process before dropping gold with SMB. Add until solution doesn't fizz and pH reaches 1 +/- 0.4.

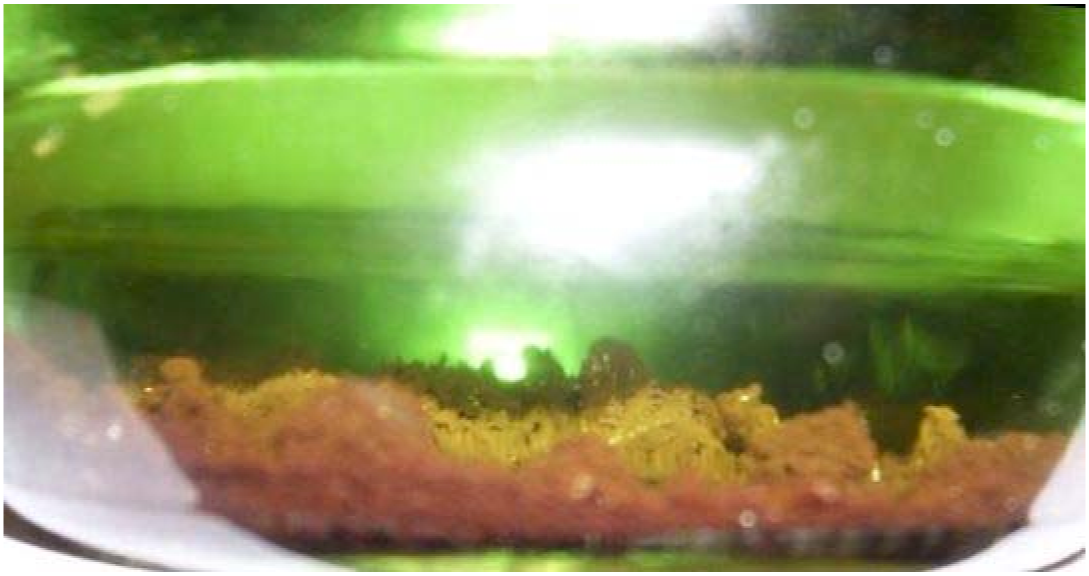
12. AgCl= Silver Chloride= White precipitate that forms when silver is exposed to chlorine in solution. Turns purple in light, darkens further in sunlight. Solid by product of using AR on lower karat jewelry. Hazardous to melt due to fumes. Production of silver chloride should be avoided if possible. Can be converted to silver metal with lye and karo syrup or HCl and Al foil.

    For 1 tr.oz. of silver metal, about 41.5 grams of silver chloride, it takes about 20 grams of sodium hydroxide, 13.3 mL of light Karo syrup, and 133 mL of water. (Thanks GSP!)

13. Inquartation= 3 parts base metal (Silver perferred) , 1 part Gold, Dissolved in hot dilute nitric acid. Powder/Honeycomb that remains is Gold and higher PGM's if present in source material. Left over liquid contains Silver, base metals, and Palladium if present in original alloy.

- Hoke states 4-6 pounds of concentrated nitric acid dissolves 1 pound of base metals. 5 pounds of 70% nitric, 1.41 sp.gr. is 1610 mL =~ 0.425 gallons.



14. $C_{12}H_{26}O_3$ =BDG or DBC= Butyl DiGlyme or DiButyl Carbitol = Organic solvent that combines with Auric Chloride and is insoluble in water based solutions. Separates from water based solutions as an upper phase (layer). After washing with dilute HCl gold is dropped as flakes using Oxalic Acid. Can be used on AR solution without neutralizing excess nitric acid.

Note : Hydrochloric acid is completely soluble in water.

Stannous Chloride Testing Solution

15. 

16. $SnCl_2$= Stannous Chloride= Used to test solutions for precious metals. Made by dissolving metallic tin in hot muriatic acid. Loses strength when stored.
    Positive color test as follows:

    Purple/Black color is Gold in solution, the darker the spot the more Gold.

    Yellow/Brown color is Palladium in solution, the darker the spot the more Palladium.

    Light/Dark Rose color is Platinum in solution, the darker the spot the more Platinum.

It's a good idea to have a standard DMG (dimethylglyoxime) testing solution on hand to test for palladium when you're in doubt. The tiniest amount of palladium yields a canary yellow precipitate. It is also useful for determining the presence of nickel----a drop of solution in a cavity of a spot plate, followed by a drop of ammonium hydroxide, then a drop of DMG will turn a beautiful pink (from dark blue) if nickel is present.

Read Hoke's book on testing these elements, and follow the instructions provided. It worked for me. Harold

If iodine is present in the unknown solution you are testing, you will get a very dark black/purple spot with Stannous Chloride.

Steve

This list is **not** all inclusive. There are many more methods to dissolve gold and base metals.

Steve

SOLUBILITY RULES

In order to be able to predict double replacement precipitation reactions, you must know which substances are soluble and which substances are insoluble. The term "soluble" means that the substance dissolves in water. In other words, if the substance is ionic, such as salt (NaCl), then the ions (Na^+ and Cl^-) are separated by the water molecules and the white solid dissolves (disappears) and a solution is formed, as when you put a teaspoon of salt in a glass of water. The term "insoluble" meas that the substance does not dissolve in water, but remains in solid form--much like coffee grounds in water, they remain solid. Below are given a few general rules for predicting whether a substance is soluble or insoluble--know these rules!

SOLUBILITY RULES

soluble ionic compounds	insoluble ionic compounds
1. 1. All common compounds of Grp. IA ions and NH_4^+ ions are soluble	1. 1. All common metal hydroxides are insoluble, except Grp. IA and the larger Grp. IIA starting with Ca^{+2} ion
1. 2. All common nitrates (NO_3^-), acetates (CH_3COO^-), and most perchlorates (ClO_4^-) are soluble	1. 2. All common carbonates (CO_3^{-2}) and phosphates (PO_4^{-3}) are insoluble, except those of Grp. IA and NH_4^+
3. 3. All common chlorides (Cl^-), bromides (Br^-), and iodides (I^-) are soluble, except those of Ag^+, Pb^{+2}, Cu^+ and Hg_2^{+2}	1. 3. All common sulfides are insoluble, except those of Grp. IA, NH_4^+, and Ca^{2+} and Ba^{2+}
1. 4. All common sulfates (SO_4^{-2}) are soluble, except those of Ca^{+2}, Sr^{+2}, Ba^{+2} and Pb^{+2}	

Concentrate Nitric Acid ?

Chris,

Nothing appears wrong with yours a first glance, except in mine I'm not leaving any Hydrogen behind as follows:

$H_2SO_4 + 2 NaNO_3 \rightarrow Na_2SO_4 + 2HNO_3$

The big difference in my recipie is the solubility of the sodium sulfate salt (as opposed to sodium hydrogen sulfate you produce) and the fact that my equation yields twice the nitric acid at a higher temperature (no dry ice, just salted ice). 😉

I've run the numbers like you did and ended up with about 160 mL of 50% nitric (give or take a few percent) for a single mole of 96% sulfuric and using 100mL H_2O to dissolve the nitre.

I won't bore everyone with the math, but here's my summary (PM me to see all the factors I used to derive this reaction):

☠

Reaction:

-Bring 100 mL of Distilled Water in a 500 mL pyrex beaker to 100 C
-Add the Nitre of your choice (202 gm K / 170 gm Na)
-Stir until Nitre is completely dissolved, let cool below boiling
-SLOWLY add 56 mL conc (96%+) Sulfuric Acid to Hot Nitre solution while stirring, DON'T allow the solution to boil!
-Allow solution to cool to room temp (DO NOT SKIP - VESSEL WILL SHATTER IF PUT ON ICE WHILE HOT!!!)
-When vessel reaches room temp (25 °C) put the vessel in the freezer or on a salt water ice bath
-Let stand until temperature of mixture reaches -5 °C
-Let stand at -5 °C until all percipitate settles
-Pour the COLD solution off into glass container with tightly sealed lid DO NOT POUR OFF ANY OF THE SALT IN THE BOTTOM!!!
-Makes ~160 mL ~50% HNO_3 K= Potassium NA= Sodium
This acid in turn can be used to make true AR with the standard 4:1 recipie (HCl:HNO_3).

Steve:

I used Sodium Nitrate (16%) and contcentrated sulfuric acid (battery acid from NAPA) that I boilded down to Specific Gravity of 1.8 Grams per 1 ML. I found that commerical battery acid is 65% H_2O and 35% of 98% Concentrated H_2SO_4. I measured the SG of the the Battery acid and found it to be 1.25 SG and then boiled 1000 ml of the battery acid down to 360 ML and remeasured the SG and it came out to be 1.80 SG per 1 ml. 1.84 sp per 1ml at 25`C would have been 98%. Unfortunately I dont have any specilized laboratory equipment for precise measuring of the specific gravity and concentration precentage of this H_2SO_4, but my calculations puts it in the 90+ % range. Catfish

You are absolutely correct about the boiling temp of H_2SO_4, My book sez 338C or 640.4F at 98.3%.

I heat the NAPA battery acid in a pyrex bowl on a hot plate out side. I also place the hot plate and all in a foot tub in case of breakage. (this also keeps the wind from effecting the heat) I heat the H_2SO_4 at 230` F with a good quality thermometer, monitoring the temp at all times. My objective is to reduce the h20 only. When I start this process, I weigh 1.0 ml of battery acid in 10 ml test tube on my gold scales after zeroing the scale with an empty test tube. I also then weigh 1 ml of distilled water and determine the Specific gravity of it which always comes out to be 1.0 SG. I always come up with 1.20 to 1.25 SG on NAPA battery acid. This is about 65% h2o and 35% H2SO4. Keep in mind I dont have a pycnometer to a be able to make a precise measurement. But this is close enough for me. Also I don't crank in the temp correction factor of .0023.

It takes me about 1 hour to boil off the required amount of water. At 230 degrees it will eventually stop boiling and condensing. There are never any odors that come from this process. After it cools to room temp, I then take 1 ml again and weigh on gold scales. It just about always comes up to 1.8 + or - .1, specific gravity. Keep in mind my scale has a + or - accuraticy of .1 gram. I then measure the volume of the remaining acid and it usually comes out to about 360 ml + or - 10ml, when I do a 1000ml in a batch.

I have done several different batches of different volumes and they all come out the same. Just the boiling times are different. I have no way to actually measure the precent of concentration of the remaining sulfuric acid. All I can do is determine the approximate precent computation by using the formula of 1.84 SG at 98.3% concentration., and do the math to come up with my precentage of concentration.

You have heard the term, " necessity is the motherhod of invention". Well I dont like all the additives and inhibitors in the drain cleaners and this is the reason I came up with this method. I buy the NAPA battery acid for $4.80 plus tax for 1.5 gallons. This will make about 2 quarts of pure 90+ % concentrated sulfuric acid for my cell and to make Nitric acid.

Catfish

How to produce concentrated sulfuric acid from battery acid.

Use regular battery acid acquired from your local NAPA store. This can be purchased in one (1) quart, 1 ½ gallons, or 5 gallons quantities. This diluted acid is inexpensive.

Assumptions:

Regular battery acid is 65% water (H2O) and 35% sulfuric acid (H2SO4). This computes to 1.25 grams specific gravity per cubic cm or 1 ml. (Often referred to as 1250 specific gravity.) This is only 1.25 x 1000ml, another way of saying it.

Distilled water is 1.0 grams specific gravity per cubic cm or 1 ml.

98.3% pure sulfuric acid weighs 1.84 grams specific gravity per 1ml.

Heat required = mass x specific heat x temperature change. 1 gram of water (H2O) takes 1 calorie to change the temperature 1 degree C.

Water (H2O) boils at 212 F or 100 C.

Sulfuric acid (H2SO4) boils at 640.4 F or 338 C.

To make concentrated sulfuric acid:

Take 100 ml of battery acid and place in a heat resistant container, Pyrex or equivalent and heat on a hot plate or equivalent heat source. Preferably out doors.

Weigh 1 ml of distilled H2O in a 10ml test tube or equivalent container on a small electronic scale in grams with at least + or – 1/10th gram accuracy. This should weigh 1.0 grams. Remember to zero your meter with empty test tube on it in-order to get an accurate specific gravity weight.

Weigh 1 ml of the battery acid H_2SO_4 using the same procedure and you should come up with 1.20 to 1.25 SG per 1 ml. This can vary somewhat due to the charged state of the electrolyte (battery acid) no problem, this is just a relative reading.

Place hot plate in a metal container in case you have breakage or mishap. I use a metal foot tub. This also blocks the wind from the hot plate and allows it to be more efficient in heating.

Place a good grade glass thermometer in the solution and monitor.

Place on high heat and watch temperature until the solution reaches ~230 F or 110 C.

The solutions will be at a low boil and you will be able to see the boiling action and also observe the steam rising off it.

Maintain the temperature at 230 F until all boiling action stops. The steam will stop rising too. Note: the amount of time for the solution to boil off all the water will be determined by the mass of your solutions. 100ml takes about 40 to 45 minutes. This may vary due to several factors, such as ambient temperature and quantity or volume of your solution.

Let the solution cool to room temperature and take 1 ml of it and weigh it like you did the battery acid. Take the remaining solution and measure the volume that is left. It should be ~ 35 ml this time you should have a specific gravity of ~1.80 per ml. if you have boiled all the water off the solution.

The remaining acid should be 90% plus if you measure 1.80 or above. Remember that pure H_2SO_4 (98.3% concentration) weighs 1.84 grams per ml. Just do the math and 1.84 -1.0 =.84 /.855 (theoretical 100% Concentration) = 98.3% Realistic concentration. Divide 1.855 into your last specific gravity weight and this product will be the percentage of concentration of your finished product. Example 1.80 -1.0 =.80/.855 = 93.6%. This should meet any requirements you may encounter in the gold recovery/refining business.

This sulfuric acid is very pure and has no additives or inhibitors. It is great for the electrolytic cell and many other uses such as making nitric acid.

Be careful. Hot acid burns.

If you have any questions send me an email or post.

Catfish

Safety and Fumes from cell

It woud irresponsible for me NOT to warn everyone here about the potential dangers involved in this sort of hobby. My conscience wouldn't let me sleep at night if I didn't. Thank you for your compliments.

The fumes from the cell are pretty much nil unless you get a bad connection on the anode and arcing occurs. There is a very slight sulfur odor with normal operation. Keep the cell covered when not in use. Sulfuric acid is not very volatile (doesn't evaporate well), the water in Sulfuric will distill off with heat but the acid itself will not. If arcing occurs the acid will break down into more volatile components and produce other gases which are more hazardous. Just be sure your connections are solid without any loose or corroded joints and you'll be ok. If you hear a buzzing noise from the anode lead you most likely have a poor connection, this is sometimes accompanied by a small arc or tiny wisps of smoke. You should address these immediately as they can shorten the life of your charger and produce the other gases. Excessive heating in the anode leads is also a sign of poor continuity.
Steve

Melting Points of Metals

	Melting Point Fahrenheit
Copper	1981
Gold	1946
Lead	621
Nickel	2646
Silver	1762
Platinum	3214
Palladium	2830
Rhodium	3567
Iridium	4435
Osmium	5491
Ruthenium	4233
Aluminum	1218
Titanium	3263

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PhillipJ wrote:

> Ok now. So if a guy has gold in AR solution, and suspects platinum, the spot plate will always show gold. Right?

Yes. But it's important that your stannous chloride solution be fresh. It loses it's ability as it oxidizes. Even with a heavy concentration of platinum, you will still get a purple stain, even if the gold content is low. In that case, it may be masked to some degree and you might not see the reaction in the spot, but the stain will remain when you rinse the spot plate. Platinum, in concentration, yields a reaction that looks much like dark coffee.

Just having palladium and gold together can be confusing. Adding platinum makes it somewhat worse----but as I said, each of them have a distinctive reaction, so you have to get used to what they look like, especially when they're mixed----and maybe even do further testing (using DMG, for example) to help sort what you're seeing. I don't recall ever having gold present and not being able to identify it, although if you had your solution down to just a few parts per million, that might be a case where you could overlook traces. Not much to worry about considering the value would border on nothing. The stannous chloride test for gold is VERY sensitive, and will detect amounts that are hardly worth recovering.

Quote:

> Aside from dropping either the gold or platinum one wouldn't know for sure if there was platinum?

That's entirely possible when working with a solution that contains a serious amount of gold, but you can do a test with ferrous sulfate to eliminate the gold, then test the solution for values if there's any question about content. Here's what you do: Place a drop of your solution in a spot plate cavity, then apply a crystal of ferrous sulfate. The crystal will precipitate the gold as a very thin sheet, or fine powder, leaving behind any other values. You can then test the cavity with stannous chloride to see if there is any reaction. If you get a purple reaction, you know the gold is not yet all down. If so, start another test, and stir the tiny sample with a glass rod, exposing all of it to the ferrous sulfate. The sample will change color as the gold precipitates. It's a good idea to have a tiny amount of ferrous sulfate left, which will indicate that the gold is all down. When there is no further action or color change, apply a drop of stannous chloride. With the gold gone from the solution, you can now see if there are other values present.

Quote:

> Also. Can any platinum be dropped after the gold has settled out?

Absolutely. That's how you effectively separate the two. You won't get a perfect separation when you have them mixed, for the first thing to be precipitated will always drag down a trace of everything that's in solution with it. When you wash what ever comes down first, you'll remove some of the dragged down values, which can be recycled for later recovery. My choice was always to precipitate gold first, but I worked with, primarily, gold solutions. The Pt group metals were often in such low levels of concentration that they could not be recovered without evaporating the solutions to concentrate them. I've mentioned time and again that the Pt group metals do not precipitate from dilute solutions. They don't. Not at all. Armed with this knowledge, and a future plan of processing everything through my reduction furnace, I simply poured all my solutions (that bore traces of values) in my stock pot, where they were precipitated on scrap steel. Residues from the stock pot were then combined with all my >>>

other >>>waste materials and furnace reduced to recover the values. You need not do the furnace work, the residues can be chemically processed just as well, so recovering traces of values on scrap steel to concentrate them is not a bad idea. All depends on how badly you want to get your hands on the values. I was willing to wait for years-----and it turned out to be about 20 of them before I recovered mine. It was a wonderful savings plan. Remember-----I've told readers I retired at age 54. Couldn't have done it without refining

Harold

CELL

Chris,

The cell can look full just from the black color in the acid. You can estimate the fullness by two simple methods.

1) How many pounds of scrap did you process. Figure 1 gram per pound for mid grade scrap. To get the most out of a rinse you should try to rinse after no less than 7 grams (5-7 pounds of scrap processed) minimal.

or

2) How many actual hours of stripping time you put in. I use this method to determine when to filter. I go for a minimum of 12 hours and a maximum of 24.

Steve

Ok I did about 15lb and I have about 19 to 20 hours on it

You should have a nice nugget, 10-15 grams.

The cell is not my own creation but the tutorials are.

Here's a note about any acid water mixtures, ALWAYS add the acid to the water not vice versa!

You shouldn't jump the gun and filter right away. There isn't as much gold as it looks like because it's all fluffy in the solution. I usually run the cell for 12-24 hours of operating time before filtering. It just saves acid this way. I'm preparing a filtering video tomorrow for the forum.

Here's a quick what to do:

Your pitcher will melt if you don't do this slowly. I recommend placing the pitcher in a large wash tub in case it melts!

Add 6 cups of water to a gallon pitcher.

☠ SLOWLY add 1/2 of the cell contents to the pitcher, THIS gets hot very quickly so take your time! Add 2 more cups of water to the pitcher to speed the cooling process.

Let the pitcher cool.

SLOWLY add the remaining liquid from the cell. Letting the pitcher cool periodically.

Rinse the cell into the pitcher with one cup of distilled water.

Rinse the cell into the pitcher with another cup of distilled water.

☠ Just add the required amount of glycerin when reusing (1/8 TSP per cup of acid). After boiling water out of diluted recycled acid.

Let the pitcher settle overnight.

Steve

Project and Reusing Acid

It's tied at 1 and 1 for which is next on the tutorials list.

> **bermudanibiru999 wrote:**
>
> Also, on how to re-use your diluted sulphuric **acid**.

Dave,
Chris (GSP) made a suggestion that has already proven valuable to me with the **acid** recycling. He said to let all the black powder settle to the bottom of the cell and carefully pour off the clearer concentrated **acid** before diluting. I tried it after processing five pounds of low grade scrap and it worked great. I poured off the upper 2.5-2.75 cups of concentrated **acid** into a pyrex dish for reuse and performed the dilution as normal on the remaining **acid** and powder.
To recycle the dilute **acid** just boil it down until no more volume is lost and reuse again. If it gets too dark green, you can put piece of SS steel in the boiled down **acid** for both the anode and cathode and run the cell unitl the copper all plates out.

Steve

Another subject. You mentioned plating out copper and nickel from the **sulfuric** after evaporating the water from the dilute **sulfuric**. I question whether this will work but, it depends on how strong you get it. You will have more luck plating out of the dilute **sulfuric** before evaporating. Use a lead anode. GSP

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HCl-Cl with Powder from the cell

Dan,

I've had good success using the HCl Clorox method with the powder from the cell. When everything was said and done I was left with an off white salt and all the black gold powder had dissolved into the HCl-Cl as a nice golden color. It took several washes to get all the gold out of the powder. Just run washes until the liquid you pour off doesn't shown the deep golden color and all the black is gone form the powder.

Welcome back... 😉

Steve

LABWARE-GLASSWARE, HOTPLATES, ETC

Only certain Pyrex containers can heated directly. They are always thin and the glass thickness is uniform. They include beakers, erlenmeyer flasks, and coffee pots.

Pyrex measuring cups, battery jars, graduates, and kitchen casseroles, etc., cannot be used over a direct flame or hotplate. The glass is thick and uneven and it will exhibit thermal shock and will break.

I too have many Erlenmeyer flasks, beakers, retort and condenser, and they will take direct heat ok.

Chris

Washes

Talking about eliminating the chlorides is a lot easier than doing it. The slightest trace of HCL in your solution when you introduce nitric will be no different than a trace of nitric when you wash your precipitated gold with HCL. In either case, you'll dissolve some of your gold.

Hey guys:

I have just finished up a batch of gold that started out looking bad. It was black, very fine and spongy. I used the method that Harold has outlined in this post on purifying gold. I am waiting on some new cupels to melt it.

I followed all the steps as far refining in AR, boiling in Hydrochloric for 5 minutes, rinsing, then boiling in water for 5 minutes, then rinsing, boiling in Ammonium Hydroxide for 5 minutes, rinsing, boiling in water for 5 minutes, boiling in Hydrochloric again for 5 minutes, rinsing, and boiling for 5 minutes in water. After all this I put it back in AR again and redid the entire process. Catfish

Atomic or molecular weight

One mole of a substance is equal to its atomic or molecular weight expressed in grams and contains 6.02×10^{23} chemical particles, which is also known as Avogadro's number of particles >>>>>>>>>>>>>>>>>> http://chem-phys.cmsu.edu/rcole/chem1104/homework/HW6.html

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Hi Mayhem:

You may want dissolve the filled or rolled gold in a solution of HLC and Sodium Nitrate or Nitrate Soda (same thing). I don't think you need to worry about shooting it or or hitting it with nitric. I just finished 20 grams of 10 and 14 karat regular gold jewelry yesterday and today. I refine quite a bit of karat gold. I use the following:

8 oz of Nitrate Soda mixed with 480ml of very hot water and dissolve it.
960ml of HLC (32%) mixed with the nitrate soda and H2O solution. Stir the solution and let it set for about 5 minutes. Salt will form on the bottom of the container. I just pour off the clear solution. This amount of (sic) Aqua Rega will dissolve 140 grams of metal (plated or filled Material) or 48 grams of solid karat gold.

I cut up the solid gold into small pieces and put them in the solution. Then take and place it on a hot plate and slowly bring it up to a boil and let boil until all action stops. should take about 15 to 20 minutes. Every thing should be dissolved. If for some reason some of the gold is not dissolved and is coated with silver chloride, then take that material and boil it in ammonia hydroxide and it will clean up to shiny gold again and put it in AR again until all is dissolved. I never use any Nitric acid or shot it. This has always worked for me and I can achieve excellent yield results out of my karat gold. I consistently yield 41% on 10 k and 58% on 14 karat. This is + or – 2% tolerance of Manufacturing standards.

After you totally dissolve the gold then I mix up 8 oz of urea in very hot water and neutralize the AR. You probably won't need all the urea, but I always mix a certain amount incase all the nitric hasn't been used up. If you get too much urea in the solution, no big problem for it is in liquid form, wont hurt anything. It's better to have too much than not enough. Filter your solution good, I use a vacuum filter and then add 1 oz of SMB mixed with very hot water, and stir good. Let it set for a few hours if you are not in a hurry. Some folks heat it up to speed up the precipitation. When you get to be an old fart you stop being in a hurry. When you let the gold precipitation. Always test the spent solution for gold with test solution. Never, never leave the table with possible gold left.

Make sure you use a heat resistance container. I use Erlenmeyer Flasks and always a glass stirring rod.

If you would like some more info on this method, PM me and I can send you an excel sheet with all my formulas on all different amounts of plated, filled, rolled, karat gold and also CPU chips. Also how to test a pins for a educated guess on just how much you can expect from a plated item.

Catfish

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Supplies for refining Karat Jewelry

Hey Mayhem:

You need to go to your local feed and fertilize store or garden center. They sell Nitrate Soda, same thing as Sodium Nitrate, 4 lbs for $6.25. This will be 16% Nitrogen. Manufacture is Hy-Yield and there are other brands too. All about the same price. This is much cheaper than sodium Nitrate and the same thing.

You can buy the Muriatic acid (Hydrochloric acid) called (concrete cleaner) from any builders supply, Lowes or Home Depot, just look in the Paint section. Be sure and ask for concrete cleaner or Muriatic acid, they will not know what Hydrochloric acid is. This will be 31 to 32% Hydrochloric acid. Costs about 4.20 per gallon

You can buy Urea from the same fertilizer stores or garden centers. Cost is $8.60 per fifty (50) lb bag. This will be about 39 to 40% nitrogen.

I buy my Sodium Metabisulfite from the chemistry store. There are many other places that sell it too. All about the same. In fact someone on the forum mentioned about having some for sale. The cost is not bad from The Chemistry Store, (10.50 for 3 lbs) but the shipping is a bitch. (12.50) UPS only

As far as different kinds of precipitants, Harold has recommended different precipitants for different chemicals. I only use the SMB. I always test the solution with precious metal detection solution to make damn sure there is no gold left. Good commercial test solution will last about 6 months and test as low as 4 parts per million. The home made solution will only last about a week and may not consistently test as low as commercial test solution. So far I have never encountered a situation where I needed another precipitant yet, but you must remember, Harold and Cris has been doing this a long time and both are considered professionals in my opinion in this field. I am just a neophyte. You may want to pm them and ask their advice or recommendations.

When you get all your stuff lined up, hit me on PM and I will walk you through the first batch, it if you want.

8 oz of Nitrate soda .50
32 oz of hydrochloric 1.05
8 oz of Urea .09
1 oz of SMB .48
Total per batch 140 grams _____
of pins or 48 grams of karat $2.12
or about $7.00 per pound of pins.
gold.

If you should get some urea that has trash in it, no problem, just let me know and I will tell you how to handle it.

Gold Refining Community
Gold Refiners helping one another !

Post subject: What else is in the HCl-Cl Solution

Rainmaker,

If you do the steps proceeding the use of HCl-Cl you shouldn't have any other metals worth mentioning in the mix. If any PGMs happen to be in the mix you should be able to drop them as you normally would (NH_4Cl for Platinum followed by Sodium Chlorate for Palladium). I haven't even tested these two metals with the HCl-Cl to see if they will dissolve in this mix. I'm fairly certain Pd will, but I'm skeptical as to whether Pt will or not. One day I'll get around to testing this.

A good indication you have other metals in the solution would be any other color aside from golden yellow (i.e.: blue, green, brown, etc).

Post subject: Potassium nitrate vs. sodium nitrate

I don't know about how the potassium would affect the effectiveness of the AR mix, but either will form the HNO_3 required plus a salt that stays in solution (NaCl or KCl).

I would assume that as long as you adjust the ratios of the salt in your formula to account for the difference in atomic weights of potassium vs sodium you would be okay.

Both substances contain the same molecule you want 'NO_3', you can actually make Nitric Acid out of either salt. Here is a quick how to (this is a VERY DANGEROUS ACID, It will stain your skin, eat your flesh, burn your eyes, and it's vapors can kill you two weeks after you breath them !!!) BE CAREFUL, BE SAFE, DON'T BE CARELESS OR STUPID! I'M NOT RESPONSIBLE if you bring about your own SELF DESTRUCTION!:

Mix two parts of the salt (Na or K Nitrate) to 1 part H_2SO_4 conc (Sulfuric Acid- Main line septic line cleaner from hardware store) and distill (all glass rig) the HNO_3 out of the mix. You can get 60-70% HNO_3 this way if you keep the still head temperature at 83 C and the receiving flask on ice.

There is even a 'speed method' where you mix the above chems, let sit overnight, filter out the solids and use as is. I've never tried this one so I can't vouch for it.

Personally I use the lab grade 70% stuff when I need HNO_3.

Steve

Post subject: Why two processing methods?

Teabone,

By using the first method (peroxide acid) to dissolve the just base metals and not the gold, you will end up with a cleaner gold powder when it is dropped out of the second solvent (HCl-Cl or AR). As you have read time and time again on the forum, the purest gold is that which is first throughly cleaned of base metals, then dissolved and precipitated. A second cycle of cleaning and precipitation yields even higher quality gold. If you were to attack the gold and base metals outright using the acid peroxide bath the gold and copper laden liquid would drop gold when treated with SMB, but the gold would not be as pure as it would be if it was separated from the base metals first.

In practice you can remove the base metals with many techniques, including using the HCl-Cl to remove the base metal first. The idea behind using the peroxide acid to strip the base metals as a first step comes from the fact that the $CuCl_2$ formed from the acid peroxide attacking copper is a really good solvent for Copper coupled with the fact that the same mix is only a fair solvent for gold (1/45 the dissolution rate of HCl-Cl and 1/450 the dissolution rate of AR). In short, the acid peroxide ratio is such that it is meant to catalyze the formation of $CuCl_2$, not for the dissolving of the gold. By performing the acid peroxide reaction at room temperature, the likelyhood that the gold will be dissolved is reduced even further.

This duality of function of the acid peroxide method is leading me to believe that I should modify it yet again to be the Copper Chloride method. This way it will clearly be tuned to attacking the copper cladding and not the gold. The new and improved method will have the added benefit of having zero acidic fumes. I'm still researching the best solvent for copper when safety, speed, efficiency, and reusablity are factors.

Steve

Post subject: Procedure corrections

Here's how it should read:

1. Harvest fingers(I use a wet Tile saw with a Diamond blade) No Bling, Bling
2. Soak a plastic strainer inside a bucket with a mix of 2:1 HCl/Peroxide
3. Pour off ONLY green liquid into a second bucket thru 5-6 filters
4. Test reaction solution with Stannous Chloride
5. Rinse foils in first bucket 3x-5x with HCl
6. Rinse 3x-5x with water until rinses are clear. Filter rinses into spare plastic jug.
7. Add clean rinse filter foils to first bucket
8. Transfer ALL CLEAN foils to small reaction vessel
9. Wash Gold foils in HCl\Clorox 3x-6x until all foils are dissolved
10. Filter Auric Chloride washes into large glass jar
11. Rinse HCl\Clorox reaction vessel into large jar
12. Drop with SMB
13. Let powder settle overnight
14. Test liquid HCl\Clorox with Stannous Chloride
15. Siphon off liquid
16. Wash mud test for purity
17. Smelt it
18. Hide it in Secret Bunker under house

It has everything to do with how you're refining.

There are NO shortcuts. If you want pure gold, you MUST follow accepted practice. Remember, those that went before us have gone through this time and again----and have perfected a process that will yield good quality------so if you're interested in achieving that level, follow instructions that are at your disposal. Don't experiment-----leave that for others with time on their hands that are content to re-invent the wheel. This is particularly important for you, considering you're trying to establish a refining service.

Depending on what you're starting with, you may have a hard time achieving a good level of purity the first time through. That's to be expected. Part of the problem is mechanical drag-down, where you're working with very heavily contaminated solutions, part of which follow the gold. They're not always easy to wash out, even when boiling with HCL.

CONT
CONT

My advice to you is this:

Process your gold the first time, using conventional means. Allow as little in the way of contaminations (metals) as is humanely possible, to be included with the gold. Use only clean vessels. Wash them well between operations-----and use BonAmi cleanser if necessary to remove stubborn stains. Do not use other cleansers, for they scratch the glass. Filter before precipitating, and insure that the filter does not allow particulate matter to pass. If it does, re-filter, or go to a better filter grade. A Whatman #2 does an outstanding job for first refined metals, although they are not cheap. I used them exclusively for filtering first run gold chloride. I felt they were worth the extra money. At all times, keep your beaker covered with a watch glass of appropriate size, to prevent contamination from other sources.

Precipitate your gold using conventional methods, collect it and wash it well. It's best to use a precipitant that does not add contamination. I preferred SO2, but there are others that work equally as well, I'm sure.

First wash should be in boiling HCL and tap water. Boil for a prolonged period of time. Take up the solution with tap water, decant after the gold has settled, then rinse with tap water, which should again be brought to a boil. After it has boiled for a period of time, add more tap water to cool the lot, then decant as before. Rinse again, and do it until the wash water comes off clear. Next, wash the gold with ammonium hydroxide and tap water. Heat it until it boils. You'll notice that the solution gets discolored. How much is determined by how dirty your gold was when you started. The ammonia evaporates fairly quickly, so you can't boil very long. Add tap water to cool, decant, and follow up with a tap water rinse, again, boiling the water. Add tap water to cool, then decant. You now repeat the HCL and tap water wash. You'll be amazed that suddenly more contaminants will come off. Boil well, add water to cool, decant, repeat the water rinse, decant, then, and this is important-------start the refining process all over again by dissolving the well washed gold powder in aqua regia. I'll talk about that in a minute, but these are indicators you should have observed along the way, aside from the fact that you could see contaminants being washed from your gold powder.

The gold powder, which started out quite dark, is now much lighter in color.

It may have been rather loose and flocculent, but now is eager to agglomerate, so it forms lumps and settles quickly.

While these instructions sound like a lot of wasted time, when you process what you think is pure gold, you'll see evidence in the remaining solutions that it was not. The evidence of which I speak will be in your solution when you've extracted the gold for a second time. It's a lot of work which is why I re-refined my gold in large lots, often as much as 200 ounces at each refining, so the time spent yielded a large return.

When you precipitate for a second time, one of the things that you can do to help eliminate unwanted elements is to use a different precipitant than the first time. I never bothered with that, but it's good advice if you're fighting with a given contaminant and can't get rid of it by other means. That was never a problem for me.

Wash the gold powder the second refining by the same methods and sequences as the first refining. Make sure all your equipment is scrupulously clean. Force dry the gold when it's washed by heating the beaker at a very low heat for a long period of time. Avoid allowing the beaker to achieve boiling temperature---you get minor steam explosions that blow gold out of the container. As the gold dries, it's a good idea to swish it around the beaker occasionally, which prevents the gold from bonding to the beaker. The residual matter in water tends to form around the gold and bond it to the beaker. While it's a contaminant of sorts, it does NOT alloy with your gold, so it is not a source of lowering the fineness unless you have strange elements in your water. For me, it was not a problem. >>>>

>>>Once dry, you can then melt your gold. A clean, never used for anything but pure gold, dish can be used. It should be covered with a coating of borax, but nothing else. DO NOT USE ANY SODA ASH. If there are any oxides present, they'll be reduced and absorbed by the molten gold instead of locked in the flux.

Your torch should be cleaned of loose crud before melting your gold. Run fine abrasive cloth over it until it's very clean, then wipe it down with a damp cloth to remove any traces of dust. Think clean every inch of the operation-----otherwise you undo all the hard work you've done getting your gold pure.

Your other option is to operate a small gold cell, but you must have several ounces of pure gold for the electrolyte.. That is likely not a viable choice for you at this point in time.

Harold

GENERAL

Nitric acid (and likewise for other acids) can exist as the HNO3 molecule where the hydrogen and nitrate ion are bonded together. When nitric acid is dissolved in water, the HNO3 molecule completely dissociate into the H+ ion and NO3- ion. It's the ions that will attack the metal you are dissolving, not the HNO3 molecule per se.

Concentrated nitric acid has so little water in it that most of the nitric acid exists as a molecule instead of ions. Adding water to the acid allowed the molecules to dissociate, which allowed the acid to work on the metal.

In chemical analysis, a test for nitrates involves the addition of a solution of ferrous sulfate to the substance to be tested, followed by the addition (without mixing) of a few drops of concentrated sulfuric acid; the presence of a nitrate is indicated by the formation of a brown ring—of $Fe(NO)^{+2}$ complex ion—where the sulfuric acid contacts the test mixture.

Salts are formed by metals, oxides or hydroxides from the cation side, and oxides or acids (sometimes nonmetals) from the anion side

Chlorine, of course can react with ethanol, but you are talking about solubility. Solubility is a physical process that cannot be written a chemical reaction.

Here's a more complete set of reactions that are happening in when you add aqueous sodium bicarbonate to aqueous hydrochloric acid:

$Na_2CO_{3\,(aq)} + HCl_{(aq)} \longleftrightarrow NaHCO_{3\,(aq)} + NaCl_{(aq)}$
$NaHCO_{3\,(aq)} + HCl_{(aq)} \longleftrightarrow H_2CO_{3\,(aq)} + NaCl_{(aq)}$

$H_2CO_{3\,(aq)}$ <--> $H_2O_{(l)}$ + $CO_{2\,(g)}$ >>>>>>>>>>>
>>>>>>>>>

If not enough HCl is added, then there won't be enough HCl to drive the equilibria all the way forward to favor the production of a lot of carbon dioxide, or the production of carbon dioxide will be too slow to cause bubbles to form (i.e. the gas will exchange only at the surface). If you add a large excess of HCl to aqueous sodium bicarbonate, you should see bubbles form.

Reducing Silver Chloride

Wash your silver chloride well, until the wash water is clear, with no traces of color. You can do that with tap water. Make at least one of the washes with hot water, to dissolve any lead nitrate that might be present. If you make that wash the last, or second to last wash, you'll notice that the silver chloride will settle almost instantly, so you can decant while the solution is still hot. Lead nitrate will self precipitate when the solution cools, defeating the purpose for the hot wash.

I used a thick-walled Pyrex container for the conversion. There's enough heat generated that your chloride can achieve boiling temperature, so don't use glass that won't tolerate heat. Don't do this indoors unless you have a fume hood. There's a considerable amount of gas and vapor liberated in the process.

Place your chloride in the container, and cover it with a 10% solution of HCL and water (tap water is fine). A large diameter container with a shallow layer of chloride is best. You need room to stir. If you have access to scrap sheet aluminum, it works best, for it presents a large surface area to the chloride, and is easily recovered when the operation is complete. Smallish pieces that can be stirred work well, for you have to expose all of the chloride to the aluminum. Avoid tiny pieces that would be difficult to remove when the process is finished.

At first, the chloride will have a tendency to stick to the aluminum, but as it all converts to elemental silver, you'll find that the aluminum will shed it totally. The aluminum goes into solution in this process, so expect it to dissolve as it works. Make certain that the chloride has converted to gray (silver) and there's still some aluminum left. At that point the aluminum will bubble, being dissolved by the HCL, and will be very clean, but there is, otherwise, no action. When you're convinced the chloride has all been converted, remove the rest of the aluminum, checking any place that yields bubbles for small pieces that may be left behind. It's not a bad idea to add a little free HCL after you remove the aluminum, which will insure that the silver is well washed, and will expose any tiny pieces of aluminum that may be left behind. Allow things to sit for a few minutes. If there's any aluminum left behind, you'll see bubbles coming from the location. When you're sure you have all the aluminum, fill the container with tap water and allow it to settle. The solution will appear to be about the same color as the silver, and you'll swear there's silver in suspension, but that is not the case. Allow it to settle for a day, then decant the solution and repeat the wash. The wash will slowly come clear, but it takes a few repetitions. Once the solution is fairly clear, it will filter well, but the dark solution won't go through a filter worth a damn, so don't try filtering until you've washed the silver a few times.

My policy was to place the well washed silver in a Buchner funnel, where the balance of the solution could be removed and the silver compacted well for drying. It's a lot easier to handle the stuff after it's been compacted. I would then dump the Buchner contents into a large evaporating dish to force dry the silver over a low flame. The silver that comes from this conversion is very fine grained and sticky. It melts well once dry, but flux (borax, without soda ash) is a definite asset. The flux should be saved for future re-processing. It could contain traces of unconverted silver chloride, and possibly some prills. Soda ash would convert the >> >>>>chloride traces to elemental silver, but it would also convert traces of base metal oxides should they be present, so I avoided using it. All depends on your objective. If the silver is headed for a silver parting cell, the cleaner the silver, the longer the electrolyte will be viable. How you'll use the silver will determine how to flux. If you use it for inquartation, over and over, use some soda ash in your flux. You'll achieve a 100% recovery (of chlorides) that way.

Hope I've covered it well enough for you to proceed. It will take only one attempt at the process for all of this to make sense.

Harold

TABLE 1: Substances Found in a Desktop Computer

(Based on a desktop computer weighing 70 lbs.)
NAME % TOTAL WEIGHT USE/LOCATION

plastics 22.9907 housing
lead 6.2988 CRT, metal joining
aluminium 14.1723 conductivity/housing,CRT
germanium 0.0016 semiconductor, ckt board
gallium 0.0013 semiconductor, ckt board
iron 20.4712 magnetivity/(steel) housing,CRT
tin 1.0078 metal joining, CRT
copper 6.9287 CRT, conductivity, connectors
barium 0.0315 CRT, getter in vacuum tube
nickel 0.8503 magnetivity/(steel) housing,CRT
zinc 2.2046 battery, phosphor emitter, CRT
tantalum 0.0157 capacitors, power supply
indium 0.0016 transistor, rectifiers
vanadium 0.0002 CRT
beryllium 0.0157 ckt board, connectors
gold 0.0016 connectivity, conductivity
europium 0.0002 ckt board
titanium 0.0157 housing
ruthenium 0.0016 ckt board
cobalt 0.0157 CRT, ckt board
manganese 0.0315 CRT, ckt board
silver 0.0189 ckt board
antimony 0.0094 CRT, ckt board
bismuth 0.0063 ckt board
chromium 0.0063 housing
cadmium 0.0094 CRT, ckt board, battery
selenium 0.0016 ckt board
niobium 0.0002 housing
yttrium 0.0002 CRT
mercury 0.0022 ckt board, batteries, housing
arsenic 0.0013 ckt board
silica 24.8803 glass, CRT, ckt board

Gold Refining Community
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Getting pure gold (shining)

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While these instructions sound like a lot of wasted time, when you process what you think is **pure gold**, you'll see evidence in the remaining solutions that it was not. The evidence of which I speak will be in your solution when you've extracted the **gold** for a second time. It's a lot of work which is why I re-refined my **gold** in large lots, often as much as 200 ounces at each refining, so the time spent yielded a large return.

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Your other option is to operate a small **gold** cell, but you must have several ounces of **pure gold** for the electrolyte.. That is likely not a viable choice for you at this point in time.

Harold

How to clean gold.

Post subject: How to clean gold.

Folks we spend a lot of time discussing many different types of refining techniques and ideas. I am pleased with the refining techniques that I feel comfortable using and now I have became interested in trying to obtain purer gold than I did before.

I have read many good posts by Harold on obtaining pure gold and decided to take the time and perform all the steps that he has so graciously told us about.

I refine most all my gold in “poor man’s aqua regia” and obviously as you can see from the first photo that the end results are totally unsatisfactory. I have been using Harold’s cleaning method on all my gold now and are very satisfied with the results.

Photo 1 and 2 shows two small batches that I ran through AR for a beta test for determining the amount of gold in electronic scrap.

I took both batches and boiled it in water for 5 minutes, boiled in hydrochloric acid for 5 minutes, then boiled in water for 5 minutes, boiled again in ammonium hydroxide for 5 minutes, boiled in water for 5 minutes, boiled in hydrochloric acid for 5 minutes, and then boiled in water for 5 minutes. See photos 3

After this washing process I ran the gold chloride through aqua regia again, but I precipitated it with iron sulfate this time and then ran the chloride through the same wash cycle as before. I then dried the chloride and accumulated enough of it to make a sizable nugget.

I also took Harold’s advice and only put a very small amount of anhydrous borax in a new melting dish. I melted the gold in 5five separate buttons and then I added all them to gather and made the final nugget. I have made arrangement to have it assayed. It will cost me $25.00 so I decided to just make one nugget. It should all be the same I hope. See photo 4

Note how clean the melting dish came out after all the melting’s. I think this tells a person a lot about the quality of their gold by looking at the finished dish and the dark brown or green colors sometime you get. See photo 5

Again, I want to offer my sincere thanks to Harold for sharing all the many wonderful ideas and past experiences with us folks. Three months ago, I was just happy to be able to refine gold and was not too concerned about the quality of it. But now I want to be able to do much better than I used too.

Thanks .

one beta test was 50 sticks of DIMM 100 memory. The fingers yielded .4 grams of gold on first AR and .3 grams on final process.

Two beta test was 152 SCSI controller circuit boards fingers. The fingers yielded 1.2 grams of gold the first run and 1.1 grams on the second and finila process.

I am trying to make a tutorial on how to determine the amount of gold in circuit board scrap. These two tests were part of this exercise.

Catfish

All,

I, too, would like to offer my thanks to those of you that have had enough confidence in me to follow my advice. I take precious little credit for the words I post, just repeating things that I learned from my extensive studying of Hoke along the way to becoming a refiner. There's not much new in gold refining, it's just a matter of following the recipe and using good work practice.

I'd like to comment on the length of boil time when washing gold. I usually did not set time limits on my washing operations, and often would allow a solution to boil for a considerable length of time. When re-refining gold, a wash that lasted for a couple hours was not unusual. A close watch on what is happening will be most revealing, and is a good indicator of when to move to the next step. If the gold starts out quite dark, but you notice that prolonged boiling lightens the color, by all means, boil longer. Do the same thing for each and every repetition----it pays dividends in yielding a much higher quality of gold. You may not achieve that magical 4 9's we hear so much about, but you should be able to achieve better than 9995.

I couldn't help but notice a slight discoloration in the bottom of the melting dish in the pictures that were posted. Assuming the dish was used only for the gold in questions, I'd suggest the gold that was melted still had a trace of base metals included. The prolonged boiling may very well remove them, although there's no guarantee it would. Gold that is not contaminated will not discolor your dish aside from traces of colloidal gold, turning the flux a nice purple color over time.

There are a couple signs you may wish to look for when melting your gold. If the surface is not shiny while the gold is molten, and you see a dull layer that is active, moving towards the edge of the button and being absorbed by the flux, there is no question the gold is not pure, although the degree of contamination may be miniscule. Pure gold will melt with no discoloration, no dullness, and freeze shiny and smooth (and yield the characteristic deep pipe), although with a crystalline structure on the surface, usually quite coarse. If it freezes with miniscule crystals and has a frosty appearance, it is contaminated with something---although it may or may not yield an oxide covered surface. Not all contaminants do. Silver, for example. Any discoloration or dullness is a sure sign of contamination.

Melting gold under a complete borax flux cover has a tendency to yield gold that looks good, but it may not be as it appears. The flux cover will prevent the oxidation of included base metal traces, so the surface will show no signs of oxides. That doesn't mean they traces won't be included in the gold should you have it assayed, because borax doesn't have the appetite for clean metals as well as it does for metallic oxides. By melting without the flux cover, you increase the chance of oxidizing the unwanted traces, and the thin flux covering in your dish will then absorb them. That should explain the slight green tint you see in the bottom of the melting dish posted by catfish. Remember----gold does not oxidize under normal circumstances, so it can be melted without fear of forming oxides, assuming it is pure, and your melting procedure doesn't contaminate the batch.

Excellent work, catfish. I hope you've enjoyed the journey towards perfection.

I found the challenge of improving my gold quality an ongoing process, and was still seeking perfection when I sold my operation, in spite of having achieved a level of excellence of which I was very proud! I think you've all seen a picture of the gold shot I've posted a time or two. It represents the last batch of gold I processed before transferring ownership of my refining business to the buyer. The gold in the photo came from the shotting operation with no pickle necessary to improve appearance. I think I was getting very close to that magic 4 9's!.

Harold

BDG

Paige,

Your problem could be related to the acid molarity in your AR. The patent for BDG use states the HCl concentration of the pregnant solution should be between 0.5N and 1.75N, that is 0.5 mole HCl per liter to 1.75 moles HCl per liter. Diluting your AR could be one solution to your trouble.

Another possible solution is that your BDG may be saturated with gold. According to the same patent BDG will hold approximately 10 grams of gold per 200 mL. Following the patent guidelines of a 50/50 ratio of AR to BDG in the funnel you have 200mL diluted AR to 200 mL BDG in a 500 mL funnel. The good news is that you can reuse the BDG after you drop the gold from it using aqueous oxalic acid.

As Noxx stated you need to really shake the funnel vigorously to get the BDG in contact with the AR solution. Don't drain off the stripped AR lower layer until the top layer has settled out clear. The patent recommends a 10,000 RPM centrifuge to speed the separation. Put all your lower layers in a separate vessel and test for gold after the first pass of BDG. The patent recommends 2 extraction passes and 3-5 dilute HCl rinses of the BDG afterwards.

I hope this helps you solve your problem.

Steve

Thank you for helping me, Noxx.

This gold in my AR has been thru three passes, with in between cleanings of water, HCL, Sulfuric acid, ammonia, ammonium chloride, sodium chlorate, (to get rid of any PMG's). My AR is a rich golden color, but with each pass with DBG, it doesn't seem to be picking up much of the AR. The AR remaining at the bottom of the sep funnel is still dark golden yellow, and as I run it through, the DGM only seems to be picking up very little of my AR-Gold chloride. I used a minimum of Nitric so I didn't have much to cook off. DID NOT USE urea. It's like the AR has a mind of its own and doesn't want to give up any gold chloride!

I did shake it for several minutes. And let it sit for over an hour.

I have tried using 250ml of DMG w/ 250 ml AR. 250 ml DMG w/ 200 ml AR.

H E L P ! ! !

Paige

HillD2K wrote:

> What happens to the HCl after dissolving the base metals?
> Can it be recovered to be used again?

Noxx is right the HCl becomes metal chlorides. The important thing to note about the chlorides formed is that some are actually better at dissolving certain base metals (ie: copper) than HCl is! CONT
CONT
If you read the Copper Chloride document on my website you can see that Copper Chloride (formed when AP dissolves copper from pins and fingers) can be regenerated back from the spent form (CuCl= cuprous chloride) to the active copper hunger form (CuCl2= cupric chloride) by simply bubbling air thru the solution. Another method is to add more peroxide as I demonstrated several times in the Acid Peroxide Tutorial.

Once you drop the copper out off the solution you will need more HCl to reform the CuCl2. So if you want to reuse your AP solution just don't drop the copper and bubble air thru it. It will lighten to a nearly clear green/blue color and be ready to eat more copper metal.

You may need to add a small amount of HCl if the acid level gets too low in the solution, but I've actually used just CuCl2 crystals, Peroxide, and water to etch fingers before. You can make your own crystals by evaporating the emerald green AP solution when your fingers are done. You should filter it good before evaporating.

The reason I drop my copper is that over time the solution continually is growing due to the amount of copper it is absorbing. You end up with a greater volume of solution than you started with. You'll have so much copper chloride on hand you have to find a way to get rid of it!!! Trouble with Tribbles I guess!!!

Here's the science behind the reaction:

Copper(II) dissolving Copper Metal (0) = 2 Copper (I)

Cu(++) + Cu(0) = 2Cu(+)

and the simplified re generation step which requires H+ (acid) and Air 2O:

$4Cu(+) + 2O + 4H(+) = 4Cu(++) + 2H_2O$

Notice the extra water on the right side.

The Cu++ is charged positive 2 and attracts the lower charged Cu+ into the solution. The energy required to do this is lost from the Cu++ and it becomes Cu+. When all the Cu++ are used up you need to rejuvenate them.

This is a very simplified example of a more complicated reaction, but you all should get the point. The Cu++ is doing the etching and needs to be rejuvenated occasionally with oxygen.

Steve

Gold Refining Community
Gold Refiners helping one another !

GENERAL

You may not have palladium at all. I suggest you secure at least a small amount of DMG----but use it strictly for testing----not for recovery of palladium. It produces so damned much precipitate that it's beyond a joke, and is very difficult to handle. The fact that it produces a huge amount of precipitate is exactly why it is the best test of all for the presence of Pd. It produces a brilliant yellow substance that is hard to miss, even when very scant. Hoke, in her book Refining Precious Metal Wastes, provides proper guidance for making the test solution.

I've commented before, but I'll do it again----DMG is also useful for determining the presence of nickel----it's a wonderful testing tool to have in your arsenal of supplies.

Anyone that refines should become familiar with all of the metals one might encounter, even if they are not your objective. You may not care if they're there or not, but it's nice to know what is, to help in identifying unknown metals by eliminating those with which you are now familiar.

The reaction you achieved may well not be Pd. Not saying it isn't, but minute traces of gold in a solution that is not well balanced, coupled with questionable stannous chloride, can yield strange results. A test with DMG would be very useful in this instance.

One thing to consider: The platinum group will rarely precipitate from a solution in which it is not concentrated. If you had but traces of palladium, assuming you had any at all----your chance of recovering by conventional methods would not be good. You might consider recovering it with copper, which will selectively remove only metals of value, not the base metals you likely have in solution. You might also consider putting your relatively barren solution in a stock pot, where the values will be recovered on scrap steel, along with some of the base metals. By doing so, you'll concentrate the values from various solutions, with the possibility of recovering them when there is an abundance. They can be chemically processed, or you can run the residues in a furnace.

Harold

Steve, I read somewhere that the 1% DMG distilled water solution works faster and more efficiently than the alcohol solution. I know, from experience, that the DMG will finally dissolve in water. Takes a little heat, time, and shaking or stirring.
Chris

goldsilverpro wrote:

> Steve, I read somewhere that the 1% DMG distilled water solution works faster and more efficiently than the alcohol solution. I know, from experience, that the DMG will finally dissolve in water. Takes a little heat, time, and shaking or stirring.

I always made my DMG test solutions with distilled water and prolonged heating. For the most part, it works fine, just slowly. On rare occasion it would not dissolve easily, so a hard boil was employed.

I wonder---considering alcohol evaporates at a lower temp than water, couldn't a small amount of alcohol be used to dissolve the DMG, then evaporated after the addition of the proper amount of water? Using a small beaker, one could evaporate to the proper witness line and be, for the most part, free of alcohol, which would come off somewhere under 200° F, leaving behind the majority of the water so you'd be working with known concentration. If nothing else, you'd lower the alcohol content significantly.

Ever give that a try, GSP?

Harold

Refine Gold filled jewelry

Hello Noxx,

What is the difference between the Gold stripping Cell, and the Karat Gold cell? Is the electrolyte the same? I know the anode in the Karat cell is graphite and the anode in the stripping cell is Lead. But I don’t know the particulars as to the electrolyte and how the Karat Cell is run and used. I would love to see a home made karat Cell work, As opposed to the stripping cell, as to better decide on the best way to approach Gold Filled and Karat Gold items…THX...<*\\\><..TOM

Gold stripping cell is made for de plating gold that was electrically plated. The Karat cell is for jewelry of any forms of karat (but mostly used for lower karat) The electrolyte is not the same. Reverse plating is sulfuric acid and Karat cell is Ammonium Chloride (easy to make at home)
I'm currently building one, I'll post pictures next week. Noxx

Hi Tom:

I have done quite a bit of gold filled jewelry and I have tried some with the cell of sulfuric and also with aqua regia. I experienced a little problem with the cell. It was very slow to strip off the gold. Gold filled (sic) is actually a very heavy plate of the specified karat gold on another alloy. I even cranked up the voltage to 14 volts and still very slow and I also never really knew when I had all the gold stripped.

I now dissolve all my gold filled in aqua regia. The absolute most gold you can have in gold filled is about 5% gold. This amount of gold works great in AR.

Example:

1/10th 12 karat of 10 grams of gold filled = .1 x 10 x .5=.5 grams/10 grams .5/10=.05%

I have just finished about 400 grams of gold filled material in three separate batches and it worked great. One batch was 8 sets of old gold filled glasses. If you want to hurry it along, just heat it to a low boil for about thirty minutes and it should all be dissolved.

Some of the other folks probably have a lot more experience than I have on gold filled refining. It would be interesting to hear from them and see what they have to say is the best way.

Catfish edited to add the followqing:

PS Tom you may run into some gold filled that is plated on top of silver. That should be marked as such. gold filled on sterling or .925 silver. If you should run into this situation, you would be better off using nitric acid on this type for it is difficult to disolve in AR due to the silver chloride coating the gold. Wait for Harold's advice on this type of gold filled. I personally never have ran into any like this.

How to estimate the amount of gold in electronics and jewelry

How to estimate the amount of gold in jewelry and electronics scrap.

Karat Gold jewelry:

9 karat gold is 9/24 = 0.375; 37.5% pure gold

10 karat gold is 10/24= 0.417; 41.7% pure gold

12 karat gold is 12/25= 0.500; 50% pure gold

14 karat gold is 14/24= 0.583; 58.3% pure gold

18 karat gold is 18/24= 0.750; 75% pure gold

22 karat gold is 22/24= 0.917; 91.7% pure gold

24 karat gold is 24/24= 1.00; 100% pure gold

Gold filled jewelry and decorative items.

1/10 12 karat = 0.10 time’s total weight of object times the karat percentage.

1/20 14 karat = 0.05 time's total weight of object times the karat percentage

Example = 1/20 gold filled 12 karat ring that weighs 8 grams.

0.05 x 8 x 0.5 = 0.2 grams of (theoretical) pure gold in ring.

Filled Value x Weight x Karat = Weight pure 24kt gold

Gold rolled (heavy plated) jewelry and decorative items

1/100 to 1/40 total weigh times the karat rating of item.

Example = 1/100 gold rolled (plated) 14 Karat ring that weighs 3 grams.

0.01 x 3 x 0.583 = 0.0175 grams of (theoretical) pure gold in ring.

Rolled Value x Weight x Karat = Weight pure 24kt Gold

Gold plated jewelry and electronics items.

One must first determine the class of gold thickness of the item in question. Once the thickness is obtained or estimated, then determine the square surface area of the item and then there are two methods to figure out approximately how much theoretical pure gold is in the item.

Decorative Applications:

Gold flash 7 micro inches
Gold electroplate 10 micro inches
Gold plate 20 micro inches
Heavy gold plate 100 micro inches

Engineering Applications

Class 00 20 micro inches
Class 0 30 micro inches
Class 1 50 micro inches
Class 2 100 micro inches
Class 3 200 micro inches

Military specifications:

Additional classes

Class 4 300 micro inches
Class 5 500 micro inches
Class 6 1500 micro inches

The formula for determining content of gold in decorative is the same as electronics scrap.

Electronics Circuit Board Fingers

Silverpro's method:

Daily price of gold times the square inch surface area times the thickness.

Example: Gold prices at $655.00 an ounce. And you have a total of 40 square inches of surface in 50 ea. DIMM 100 pin memory sticks. Estimating the class as class 0, or 30 micro inches thick plating.

Base value figure is 1/1000 Spot price per micro in. X surface area in.

0.655 x (gold price) 40 sq in. x 0.30 (thickness) = $7.86 of gold at today's prices.

Catfish's method:

Measure the square surface area of the item and total the aggregate amount of square surface area of all the items and then determine the cubic volume of theoretical gold. This final result will be in cubic inches. Then convert cubic inches to cubic centimeters. Take the result of total cubic centimeters times 19.3 and this will give you the amount of gold in grams.

One cubic centimeter of gold weighs 19.3 grams.
$655.00/31.1 grams/ounce = $21.06 per gram.

Example: Gold prices at $655 an ounce. Same square surface area of 40 inches.

40 square inches times 0.000030 inches =0.0012 cubic inches
0.0012 cubic inches = 0.0197 cc.
0.0197 x 19.3 = 0.380 grams
0.380 x 21.06 = $8.00 worth of gold at today's prices.

Actual test case on 50 sticks of memory

Test conducted on 7/5/2007 on 50 sticks of DIMM 100 pin memory.

50 sticks of DIMM memory weighs 2.03 lbs
Trimmed fingers weigh 68 grams

The gold plated surface on each finger measures

0.04 in. by 0.10 in. = total 0.004 sq. in. per pad on each finger.

There are 100 pins with both sides gold plated.

0.04 x 0.10 x 100 x 2 =0.8 sq. in. per board x 50 ea = 40 sq in. total surface.

The above mathematical derived results come out to approximately 0.38 grams of pure gold in the 50 circuit boards.

The fingers were refined in Aqua Regia and the result gold was 0.4 grams. It was refined the second time to obtain maximum purity and it came out to 0.3 grams of pure gold.

The actual test results came out very close to the mathematical results. The accuracy of the scale is in tenths of a gram, unable to get a 100th measurement.

Conclusion: The mathematical results matched the actual test results and were well within acceptable limits for the determination of gold cold content of electronics circuit boards.

Actual test case on 152 SCSI Controller circuit board fingers

Test conducted July 7, 2007 on 152 SCSI circuit board fingers.

The gold plated area on each of the fingers was

0.04 in. by 0.18 in. = 0.0072 sq in of surface.

0.0072 x 54 (foils) x 2 (sides) = 0.7776 sq. in. per x 152 fingers = 118.2 sq. in. gold plated surface.

Silverpro's method

0.655 x 118.2 x 0.30 = $23.23 of gold in fingers

Catfish's method
118.2 sq. in. x 0.000030 (class 0) =0.0003546 cu. In.

0.003546 cu. In. = 0.0581 cubic centimeters

0.0581 X 19.3 = 1.12 grams of pure gold

1.12 grams at $21.6 = $23.58 worth of gold.

The actual fingers refined in Aqua Regia yielded 1.2 grams the first process. Ran it again through Aqua Regia 2nd time for purity and it yielded 1.1 grams of very pure gold.

The test results were very close to the mathematical results. Well within acceptable limits for determining the gold content in Electronics scrap.

On both test cases:
1. 50 ea. memory sticks.
Silverpro's estimate was 0.37 grams
Catfish estimate was 0.38 grams
Actual gold was 0.4 grams #1 refining process
Actual gold was 0.3 grams #2 refining process

2. 152 ea. SCSI boards.
Silverpro's estimate was 1.10 grams
Catfish's estimate was 1.12 grams
Actual gold was 1.2 grams #1 refining process
Actual gold was 1.1 grams #2 refining process

You can see that the end results are well with in acceptable limits in calculating the gold content in Circuit board fingers or edge connectors.

Conclusion:

After evaluating the two methods of determining the approximate amount of gold in electronic scrap (circuit board edge connectors or fingers) , I recommend that the method that Silver pro uses is much faster, less complex and certainly accurate enough for all practical purposes for estimating the quantity and value of electronics scrap.

Catfish

ESTIMATING GOLD PLATING AND CONTENT

My method and Catfish's method, of calculating the gold value of plated objects, only vary by about 1.5%. Pretty close.

I hope that I don't confuse everyone but, I would like to alter my method a little bit. I think that my new method will make it easier to understand how it works. Here's the whole thing. The only change is in **(3)**, below.

Why would you want to go through this rigmarole? I use it mainly for buying and selling, when I don't have an assay. I've used it a lot to estimate the value of stuff on Ebay. When dealing scrap, knowledge is king. Although the method is only ballpark, it's better than having no idea of the value.

(1) Make measurements and calculate the total gold plated surface area. You want to know how many square inches or, how many square centimeters of surface you have. You need to break the plated part down into it's geometric shapes.

Fingers are easy because they are rectangles. You just measure the width and length of one finger, multiply these together, and multiply this answer times the total number of fingers. If you have 50 sets of identical fingers, multiply that answer times 50. All this gives the total surface area on these particular 50 sets of identical fingers. For a round thin pin, you multiply the diameter times pi (3.1416) times the length. For a thick round pin, you also have to calculate the area of the end. For a square thin pin, multiply the width of one side times 4 times the length.

Type in - surface area formulas - in Google. Some sites will give drawings of the different geometric shapes and their surface area formulas. I will look for a good one and post it in the Glossary section.

You can measure in several different ways. The cheapest way is to use a triangle shaped plastic architect's ruler. You can get plenty of accuracy using one of these rulers. Get the one that measures in tenths of an inch and learn to estimate reading it in between the lines (marks). Don't ever measure in 1/16ths, 1/8ths, etc. This would make the calculations much more complicated. For small measurements, you can place the ruler on the object and use something like a 10X eye loupe to read it.

My favorite is a cheap set of calipers that measures in a decimal part of an inch and, not in 1/16", 1/32", etc. If you can pay more, you can get one that has a dial for the last digit. The cheaper ones have a vernier and that is a little more difficult to get used to.

Probably, the best is a comparator. This is an eye loupe that has a scale built into it. You can get a variety of screw-on scales for it.

You could use a micrometer but, they are cumbersome.

(2) Estimate the gold plating thickness. This may be the most important factor. You have to have an idea of how much is needed for different types of parts. Gold plating is measured in millionths of an inch. Another name for this is microinches. I will refer to them as micro". First of all, you must understand that this is a pure educated guess. You must understand that the thickness of gold plating has changed over the years. Also, the plating on such things as fingers or pins can run all over the map. I have seen fingers that ran from 15 micro" to 80 micro". It depends on the usage requirements and which company made the parts.

On the average, Catfish has been using 30 micro", with very good success, for things that plug into other things, whether male or female, or for those things that rub against other things, such as those tiny gold plated balls in small multi-switches. This includes such things as gold plated connector pins and many fingers. This has also been pretty well confirmed by lazersteve's yields.

For things that have to be heated, in order to solder an integrated circuit (chip, die) to a package, you can figure 50 (40 to 60) micro". This includes many CPU's, sidebraze IC's, etc. It also includes hybrid packages (microwave, etc) that often contain hybrid circuits. The gold thickness on all these types of packages have run quite consistent over the years, unlike fingers.

For everthing else, you are on your own. There are hints, however. For things that just sit there, on run-of-the-mill electronic equipment, figure 15-20 micro". The gold is there only for mild corrosion protection. It doesn't need wear resistance. If you run across some rare, high tech, military part that has to withstand high current flow or a highly corrosive environment, the thickness could be out of sight. Most common modern items run between 12 micro" to 35 micro".

Two ways to really know the real gold thickness, on specific parts, is to assay them or to refine them (the whole batch or, just a few of them, as a sample). You can then measure and calculate the surface area. From this, you can calculate the gold thickness. There are specific types of equipment that measure plating thickness. The Microderm and Betascope utilize radioactive isotopes to do this. The Kocour machine actually dissolves a small spot of the plating. There is also X-ray thickness measuring equipment. Most all of these need standards in order to set them up. You can also plate backup nickel on the gold plate, make a metallurgical mount, polish and etch it, and measure the thickness using a metallurgical microscope. I have lots of experience using all of the methods and equipment (except for x-ray) covered in this paragraph. If you want more info on any of these, let me know.

A special category is gold brazes. They probably run from 500 to 1000 micro" thick. A 80/20, gold/tin braze is used around the edge on gold plated lids used to seal IC packages, such as some CPU's, side braze packages, or all-gold plated hybrid packages. Also, on many of these same parts, a 96/4 (I think), gold/silicon braze is used to attach the chip.

The mil specs and other official thickness charts, concerning electronic parts, aren't that helpful unless you know what thickness Class Number was called out when that exact part was manufactured. If you assayed parts, you could probably get some correlation between the data, however. The official decorative gold plating charts are a little more helpful, since some plated jewelry is marked. If you see a marking of H.G.E., e.g., you know it should be 100 micro" thick, when new.

(3) Calculate the gold plating value.

First, for us in the US, who have measured things in square inches.
(a) Get the spot market price of gold, in dollars per troy ounce. Divide this number by 10000 (ten thousand) on the calculator (Note: This is the only change I made in my method). This gives the dollar value of one square inch of gold plating, one micro" thick. Let this sink in your brain. For example, if the gold price were $660 per tr.oz., the value of one square inch of one micro" thick gold, would be 660 divided by 10000 or, $.066. Please note that this was a little discovery of mine and you won't find it anywhere else. I just noticed that, when I calculated the value of one square inch of one micro" thick gold, using the density of gold, etc., it just happened to be within 1.5% of dividing the spot price by 10000. Pure coincidence.

(b) Multiply this times the gold thickness in micro" and multiply this times the number of square inches you have.

Dollar value of gold plating = Spot price divided by 10000 X thickness in micro" X area in square inches.

Example: The gold spot is $650. You have 9.58 square inches of gold plate that you estimate to be 30 micro" thick.
650 divided by 10000 X 9.58 X 30 = $18.68.

For those measuring in centimeters and calculating area in square centimeters:

Spot price in US dollars divided by 10000 X thickness in micro" X area in square centimeters divided by 6.452.

You'll have to convert other currency values on your own.

Play with this. It's easier than I've made it sound. As you probably know by now, I'm a detail guy. Just remember it's limitations. At best, it's a estimate, which will often (but, not always) be a bit on the low side.

Chris

Chris,

As a side note to your excellent post, you can find the plating thickness for milspec equipment if you have the NSN (National Stock Number). There are numerous lookup sites on the internet that will give you all the plating data on the parts.

Steve

Chris the NSN is typically posted on the packaging of a part if bought as new old stock. If bought from government auction sites the NSN's are provided. Components that are large enough to be individually marked, like cannon plug assemblies will have the NSN or equivalent printed right on the side.

Here's a photo of a cannon plug assembly that I've purchased:

I cross indexed the MS3112E14-19P stamped on the housing at

http://5935.iso-parts.com/nsn/

By looking up the NSN number for the housing in the lower section of the page, I found the actual NSN to obtain the data below:

Here's the NSN Technical data for that item's NSN:

MS3112E14-19P

Note the listing for the grains of gold and plating thickness near the bottom in the section.😉

Pretty handy eh?!

Of course you need milspec items with part numbers. When you buy these items in pallet form at the auction sites they pretty much always come with the NSN information on the way bill.

This information helps tremendously when bidding for the scrap value.

Steve

Incredible.

I found the gold weight but not the thickness. Is the gold weight for only one pin. It sure seems low for the assembly (.019 grains = $.026). I once had a partner that more than financed our fairly good sized refinery and plating shop from his several hundred drums (I'm thinking 200 drums) of gold Cannon plugs. They really ran good. Of course, they were old. We cracked them open, one at a time, with a Mini Monster shear, dumped out the male or female pins, and stripped them in cyanide. Took about a month for 2 people. Gold was only about $150 back then.

Can you trust government numbers? It's been my experience that the military are not too swift when it comes to PM scrap values and how to handle it. I read the other day that they only make $8 million per year on their PM scrap program. About 99% of it must be walking away.

Ok, so here's what I get from this quick test:

The total weight of the cannon plug and 19 pins is :

19 Grams.

Each plug yields :

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7 grams of pins.

So to get 1 pound of pins you need :

454 / 7 = 64.85 cannon plugs or rounded to 65 cannon plugs.

From all this the gold yield of the pound of the pins would be :

0.019 x 19 x 65 = 23.45 grains of gold per pound of pins from 65 complete plugs weighing

65 x 19 = 1235 grams = 1235 / 454 =~ 2 3/4 pounds of plugs.

And finally the value of the gold:

$0.50 x 65 plugs = $32.50 gold value per pound of pins .

Cool!

Steve

GENERAL

Hi Tom:

You sound like you already have every thing going your way. The mix ration on the aqua regia is right on, but I would back off a little on the amount of metal you put in the solution. I have found that about 140 grams is maximum that will consistently always totally dissolve. Some metals will dissolve better than others. You can get away with a larger amount sometimes, but then when you have some very stubborn metals that take a lot of nitric to dissolve, you can wind up with un dissolved metals in your solution.

I found that about 130 to 140 grams of gold filled or plated works pretty good, providing that the items to be dissolved are fairly small. In fact I would start off with about 100 grams of small gold filled items and work up from there. If they are large items, then you may want to cut them up with lineman's pliers to small pieces. You always want to dissolve all the metal and have just a little nitric left. It would be utopia to wind up with zero nitric left, but in dealing with all the variables that is not possible every time. By having a small amount of nitric left in the solution, it is easier to tell when the solution is neutralized. Regardless when you dissolve gold plated or (sic) gold filled you will wind up with a lot of junk in the solution. Just be sure and filter it very good. I filter my solution in broad cloth (bed sheet material) first then neutralize it and then re-filter in vacuum filter again. This will get rid of over 90% of the junk. Then add the precipitant.

When you get your gold out, then use the process that Harold has outlined to us and you can wind up with some very pretty gold.

If you have any trouble with this process, PM me and I am sure we can work you through it.

Tom, I am like you, using nitric acid is totally out of the question. The cheapest I can order it is about $60.00 gallon plus truck shipping. That makes the price of business very expensive. As my good friend Aflac sez "Necessity is the motherhood of inventions". I have learned to use other methods that may not be as good as in-quarting and using nitric acid to remove all metals except the gold, but they work for me.

Tom S.

> **Ky.Sam wrote:**
>
> If you use steel to recover the copper in AR solution. If there is any gold left in solution would it drop to the bottom or would it collect with the copper?

Steel will precipitate copper, nickel, and all precious metals indiscriminately from solutions. It's a good way to recover small amounts of values, but is NOT a refining procedure because it is not selective.

If you have any copper that is not in solution and it's in contact with a solution that bears values, those values will precipitate on copper, also indiscriminately. That would include silver in a nitrate solution that might be contaminated with either Pt or Pd. While Pt is difficult to dissolve in AR, and impossible to dissolve in nitric, surprisingly, in the presence of silver, that is no longer the case. Those of you that use the inquartation process for refining karat gold will often encounter a batch that contains Pt or Pd, so your silver will carry traces of the Pt group. It is for this reason that anyone that processes karat gold should also make provisions to part silver with a cell, which is the easiest way to recover the Pt group metals. CONT

CONT

> **Quote:**
>
> Please read and clarify this if you can www.finishing.com/306/93.shtml

There is so much bad information in those posts that I recommend you ignore them. One of the glaring errors is the notion that you can create silver nitrate and melt it directly, yielding pure silver. While the concept is correct, the act of melting silver chloride in and of itself is in error. A reducing agent must be employed to effect recovery, and there was no mention of that. Soda ash acts as a reducer, but it is very hard on melting equipment, and is also not selective. Any oxides of base metals will be reduced along with the silver chloride, so the end product, while improved, will not be pure.

The best thing for you to do is ask a question about something that may be confusing you. I'll give you an answer that will be straight to the point, and explain why, assuming I'm able.

Harold

Harold in my case of the Witches brew I have. I put some angle iron in to drop the metals.

I submerged the steel and held it there for a minute it became copper coated pretty much instantly. So I drop it in and left it set for a couple of days. Went back and pumped off the top liquid to about 6 inches to the bottom.

On the bottom there was copper clumped together. Would the gold collect with the copper or would it settle out by its self?

I removed all of the copper clumps and let the fine powder type mud settle over a period of time. It is red and brown mud.

I ran the copper sludge through nitric acid and it seemed like there was very little gold flowing in the acid or settled on the bottom.
Could the gold be in the fine mud? ???

>>>>
You may have created a bit of a monster if you have chlorides present when you dissolved the copper. In this case, you would have been very well served to incinerate the sludge before attempting any further refining. That would drive off any residual chlorine, so the nitric would attack only the base metals, not any gold, assuming you had any present.

When you recover values on scrap steel, even the resulting copper gets involved in precipitating the gold, platinum or other values. In the end, everything (of value) will have precipitated on the steel and the copper. You don't get selective precipitation by this method, it's strictly a bail-out to recover values such that you can start a different process instead of tossing them.

Armed with that information, it's clear that you can fully expect that the entire lot may contain values, not only the sludge in the bottom. The exception to that can be that the copper, as you noticed, first to precipitate, might be barren of values at one point along the way, but it's difficult to know when you are at that point. You should re-dissolve everything, but you will now be looking for very finely divided particles of gold and Pt, if there was any present. >>>>

>>>> Test the solution you have already made thus far to see if you have dissolved any of the values. If not, you're in good shape. Work all of the material you recovered on steel until the acid is spent, then take it up with water and allow it to settle well. A full day or more may be required. When you are comfortable that the solids that were in suspension have settled totally, decant the solution, being careful to NOT pick up any of the solids that are at the bottom. The crud at the bottom should be your values, minus the copper, which is now dissolved. If you find you still have un dissolved copper, repeat the operation until the copper is all in solution. You now have eliminated the bulk of contaminants. If you really want to guild the lily, wash the residues well, decant, get them in a filter, dry, incinerate, wash in boiling HCL, rinse well, then dissolve in AR for selective precipitation. . The gold from this operation will be very clean, and will filter beautifully. The HCL wash after incineration eliminates all

kinds of trash that make filtration difficult, and minimizes drag down.

If you're lost on any of this, ask for clarification. The procedure I just described is the one I used when refining gold filled materials. It works beautifully! 😉

Harold

Reducing Silver Chloride

No heat. No agitation. Ideally, the starting solution should be 30 gm/l copper and 60 gm/l silver. You can fudge a little on this but, not much. The purpose of the copper is to make the crystal denser. Without it, the crystal will be fluffy and stringy and will climb all over and soon short out the electrodes.

For the copper, I would dissolve solid, clean (no solder) house wire in 50/50, nitric acid/distilled water. You can dissolve about 120 grams in 1 liter of 50/50 nitric. For the silver, use pure silver coins, US 90% coins, silverware, other types of sterling, etc. You can use US 40% silver coins but, not exclusively. You can also use silver that has been cemented out of nitric with copper, if there's no palladium in it and if it's been very well rinsed. Whatever you use, make sure that the only contaminant is copper. Many other metals will create problems. You can dissolve 420 grams of pure silver in 1 liter of 50/50 nitric.

When calculating the nitric needed for silver alloys, you'll have to take into consideration the amount of copper in the alloy (s), using the figures above. Also, when calculating the copper wire needed, consider the amount of copper in the silver alloys you're using. >>>>

>>>> After dissolving the metals, it is best to not have any free nitric left in the solution. It doesn't really hurt anything but, until it's used up, the silver crystal produced will be re-dissolved.

After dissolving everything, dilute to final volume with distilled water. Never use tap water in any part of this process. It contains chlorides and the silver chloride produced will create a cloudy solution and contaminate the crystal.

When the cell is operating, for every gram of copper dissolved in the solution, from the impure silver, the total silver content in the cell will decrease 3.4 grams. If the silver in the cell goes below about 15 - 20 gm/l or the copper goes above 100 gm/l, the crystal purity will be affected. Try to keep records and keep track of how much copper is being dissolved. Usually, you know this by the type of materials you are running. When the silver in solution approaches the danger level, you can build up the silver content in 2 ways.

First, you can calculate how much silver you need and add the equivalent amount of nitric acid. This will re-dissolve some of the crystals. This method will obviously cut into your production. >>>>>

>>>> Second, you can remove some solution and replace it with silver solution that contains little or no copper.

When I ran cells, I analyzed the solution silver content with a simple titration method. One of these days, I'll post how to do it. Then, I measured the specific gravity of the solution with a hydrometer. From this info, I calculated the copper content using a graph I had created.

The impure silver you run through the cell should be at least 90% pure. Otherwise, the silver in the cell decreases so fast that you can't keep up with replenishing it. The easiest silver to refine in the cell is silver that has been cemented from a nitric solution and melted into a bar.

It runs about 98 - 99% pure and the silver replenishment is not needed nearly as often.

At 100% efficiency, you will produce 4.025 grams of silver crystal per amp-hour. Therefore, at 5 amps, you produce 20.125 grams per hour. It is best to not go over 4 volts. If you're using a battery charger, use the 6V setting. It may or may not work at 6V. The crystal density could be severely affected and the crystals may grow all over the place. Never use 12V.

When running vertically, the crystal will fall off of the stainless cathode and pile up on the bottom of the container. The worst thing that can happen is if this pile grows to the point where it makes contact with both electrodes and shorts them out. I would suggest that you use a 5" separation between anode and cathode. Keep the electrodes about 4" off the bottom of the container.

When the crystals build up to a certain point, you'll have to disassemble the entire cell and pour off the solution to collect them. A way around this may be to also bag the stainless cathode. Leave a couple of inches of empty bag below the cathode so there will be enough room to catch the crystals.

Since you're running vertically, you'll need some sort of wire to suspend the electrodes. Stainless is the cheapest choice (gold also works). Just remember that stainless is only 1/35 as conductive as copper. The wire should be heavy enough to not overheat. You can make S-hooks from the wire.

Vertical is not the best way to do this. I think that, after you read this, you will see that horizontal is best. It should be easy to design a very small horizontal cell. I once made a horizontal one, in a one liter beaker, for my nephew's science fair project.

Good Luck!   Chris

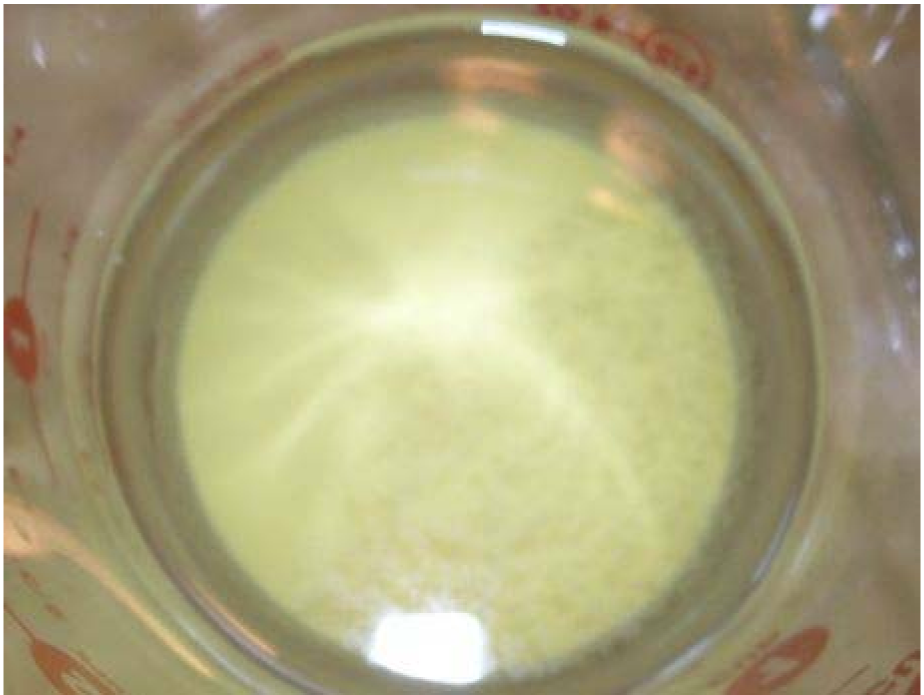
Is this Palladium?

I'm working on precipitating the extract from a batch of monolithic capacitors and have a question.

Is this what Palladium looks like when precipitated?:

The solution tested positive with stannous chloride (brownish purple) before the precipitation. After precipitation it tests clear.

Steve



Jim,

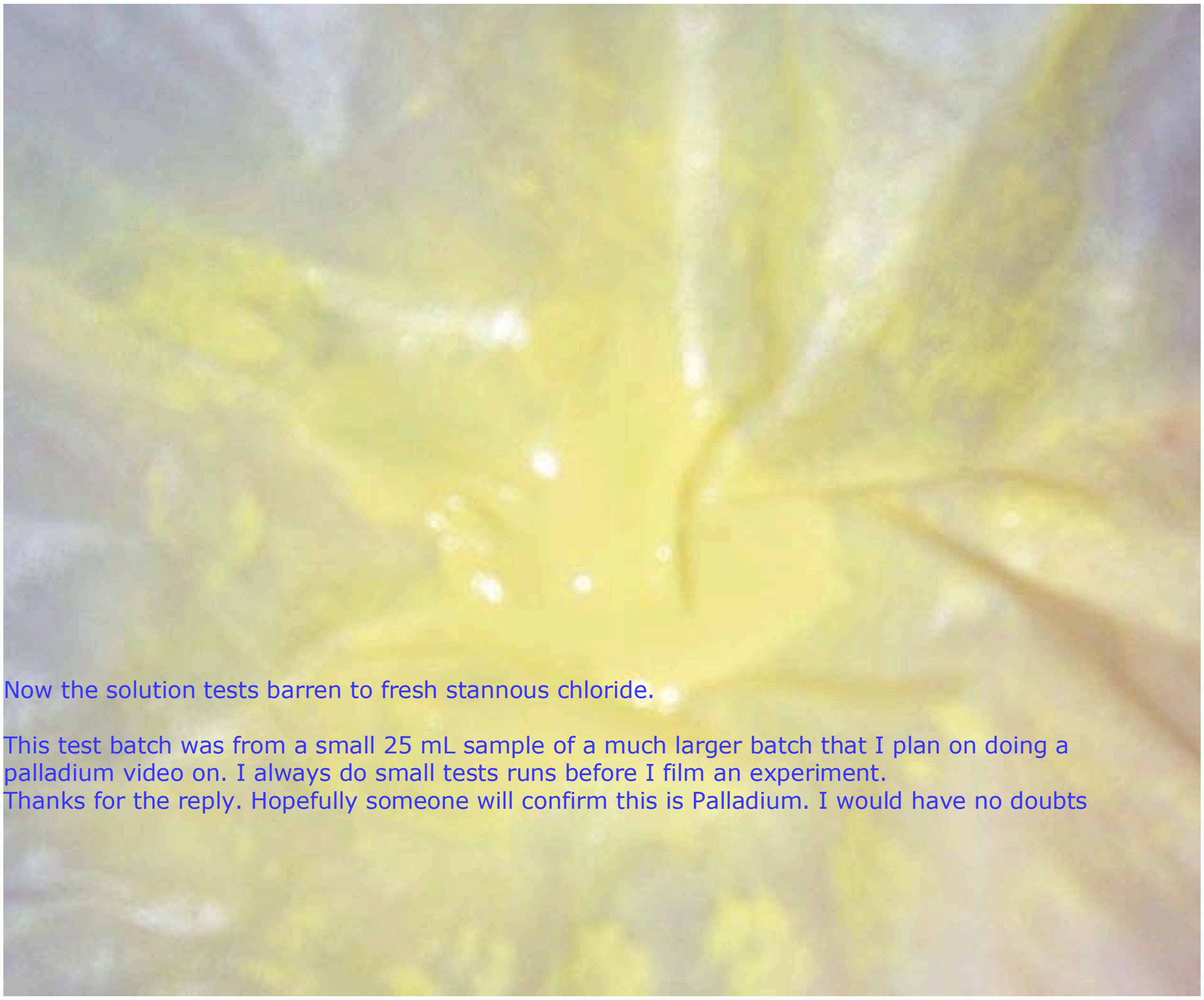
I used ammonium chloride and sodium chlorate.

I added the ammonium chloride to the hot concentrated solution followed by the sodium chlorate, but nothing happened. I let the solution sit for a few days and still nothing. I retested with stannous chloride and again had the same orange-brown/purple result. I presumed this was a mixture of gold and palladium (from the monolithic capacitors datasheet). I decided to try and drop the gold since the palladium would not drop. When I added the SMB, the yellow precipitate immediately formed.

Here's the test result: >>>>

>>>>

Here's the filtered powder:



Now the solution tests barren to fresh stannous chloride.

This test batch was from a small 25 mL sample of a much larger batch that I plan on doing a palladium video on. I always do small tests runs before I film an experiment.
Thanks for the reply. Hopefully someone will confirm this is Palladium. I would have no doubts

had the original precipitants dropped the powder.   STEVE

All,

I did my first test with DMG today. After a few drops of my solution and about 45 seconds here's what I got:

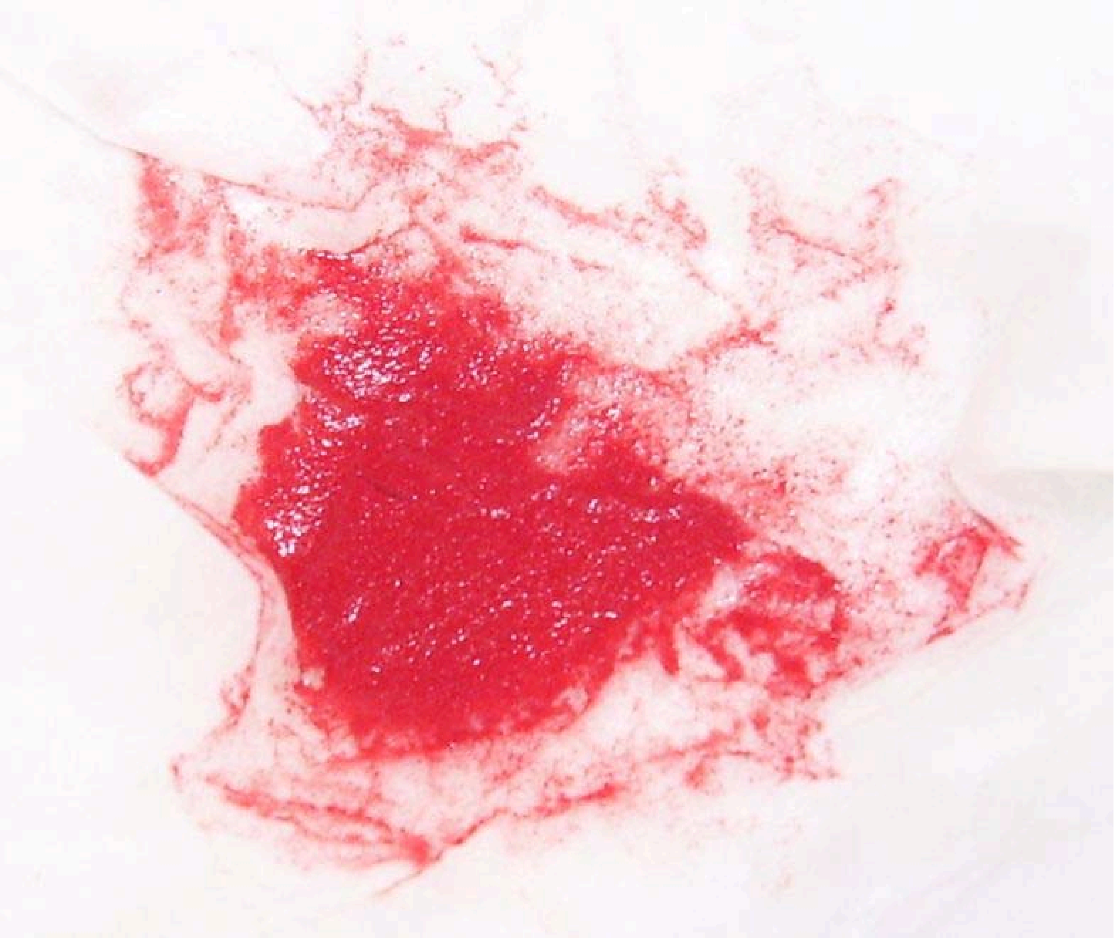
Looks like I have some Palladium to precipitate

Thanks Harold and Chris for suggesting the DMG purchase!

Steve

All,

I filmed my first run at precipitating Palladium using ammonium chloride and sodium chlorate. Needless to say I learned a lot. I kept Hokes book close at hand. Following Hokes lead I was able to precipitate this red salt from 50 mL of my Palladium Chloride solution:



I'll edit the video down in due time and post it to my website soon.

The main thing I learned is that dropping Pd is very different than dropping gold. You need to have a lot of patience and good observation skills to do it correctly. I'm sure it will get easier as time goes on. The whole reaction took over thirty minutes of tiny additions and heating. It's not something you want to do on a small scale like I did in this test run.

Rinsing is involved also since you need to use ammonium chloride instead of water.

The second most important thing I learned is that the precipitation is a balance of the ammonium chloride concentration and the sodium chlorate concentration. It is very important to concentrate the mother liquor as much as possible before beginning due to the water solubility of the resultant red salt (Palladium Ammonium Chloride). I figured out that if you add too much sodium chlorate the red salt will redissolve into the solution. A small addition of ammonium chloride will reprecipitate the red salt. I suppose this is also a side effect of the solubility of the red salt and concentrating my solution may solve this problem.

Any pointers the members can give me on this one would be great before I do the final cut on the video.

Steve

I'm not convinced that you know any less than I do, Steve. As you alluded, the precipitation of palladium appears to be a fine balance of almost everything. When conditions are perfect, it happens almost immediately, and completely, but a full precipitation is more a rarity. I often still had traces in solution, which were recovered in the stock pot rather than mess with such a small amount.

Looks really good, Steve. The color is outstanding. I took note that if my solution was somewhat contaminated, the color shifted towards a darker red---bordering on maroon in some cases.

Harold

Inquartation is the key to success. Yellow karat gold that's 10K or greater is difficult to dissolve. The gold protects the base metal from nitric, and the silver protects the gold from AR----so you have to either raise the gold content above 90%, or lower the gold content to about 25%----which is somewhat critical. If you go too far below, it doesn't honeycomb, but breaks down into fine powder instead. That makes the separation of solids from the liquid most difficult because the gold stays suspended to some degree. Anyway, the process is to remove all the base metal, then to dissolve the remaining mass (most of which is gold), with AR, evaporate, filter then precipitate, using a selecting reagent so you don't contaminate the gold. It's real straight forward, but there are necessary steps that must be observed if you want high quality gold.

Harold

> **Noxx wrote:**
>
> Is it possible, if you have 14k gold or higher, to melt it with copper (to lower it to 25%) then dissolving it in nitric acid ?
> Thanks

Yes, that works, but copper requires something like 300% more nitric to dissolve than does silver. That's yet another reason why anyone that plays with this stuff should be involved in refining, at the least, silver, gold, platinum, palladium, and even mercury, which is a great source of silver (dental amalgam).

When you're involved fully, you save your scrap silver and use it instead of copper, which is a dead end trail because of the greater nitric consumption, and the need for the copper to recover silver from solution. The silver, which is generally either coin or sterling, needs to be dissolved in acid anyway, so you accomplish two things at the same time. That's all a part of properly refining yellow and green karat gold, which is a world apart from extracting from plated items. Unlike those two, white gold could be directly dissolved in AR, but it's far better to remove the nickel beforehand by the same method (inquartation, then nitric), so the yield is of higher quality.

If you don't know, it's a high percentage of silver that makes gold green, although there's some copper there, too.

Harold

Thanks for the very flattering comment!

Nope-----can't add much. I know those things, but not the way Steve does. I know them from the school of hard knocks-----he appears to know them because he's educated. Not the same thing.

The only comment I'd make here is that you generally process silver as a nitrate, and recover with copper. Instead of attempting to do a stoichiometric conversion, it's common practice to use an abundance of copper pieces (NOT WIRE) to recover the silver. Old buss bar or other copper components are very good for the purpose. The silver that is recovered by this method will be quite pure, but always contaminated with some copper. It is, however, high enough in purity that it can be melted and parted in a silver cell with good success.

It's important to not use excessive nitric in this process. If you do, it attacks the copper until it is mostly consumed, at which time it will start precipitating your silver. It wastes both copper and nitric. Also---the solution is better slightly diluted as compared to highly concentrated. When the solution is too concentrated, it's not uncommon for the silver to plate out so solidly that it adheres to the copper as a solid sheet and is very difficult to dislodge. The silver should come down as fine particles, as I describe below.

You don't use copper wire for recovery because as it is used up, it doesn't go away uniformly, and it's virtually impossible to recover all the bits that remain when the silver is completely precipitated as what is known as "cement" silver. It very much resembles Portland cement. Once it's finished, the solution should be checked for the platinum group, especially if it has a greenish tint. Allowed to sit long enough, all the platinum group metals that may be contained within will precipitate and hitchhike with the silver. to be recovered in the silver cell.

If, by chance, the solution is very dirty, it is often better to precipitate silver as chloride, using salt. The resulting chloride can be well washed and then converted to elemental silver via the use of aluminum and a little HCL.

Harold

Thanks for the info Harold and Steve. Not that I plan to purify any amount of silver, but it is good to know how to do it just in case.

So far today I learned when to clean out the silver cell, or know what to look for when the copper limit is reached. Also that a silver nitrate electrolyte with a ph of 1.5 - 2.5 is used. I am assuming that the cathode can be either 999 silver or stainless steel.

Current density I am not sure of? My plating manual says 1 amp per 16 sq. in. of cathode and air agitation for decorative silver plating.

And Harold. I have allready copy & pasted a small book on your lessons here. Probably others have too. You allready have a good start right here for your book. Think about it.

____

Phillip J.

PhillipJ wrote:

> I am assuming that the cathode can be either 999 silver or stainless steel.

Silver would be a problem in cost and fabrication, and not really necessary. Stainless is very acceptable, although in the process of harvesting the crystals, you must use tools that won't raise burrs, or otherwise scratch the cell surface, and won't precipitate the silver in solution. I built a scraper from green fiberglass board material, about 3/4" thick, which I used to scrape down the crystals when it was time to empty the cell. The scraper had a shank made of stainless steel, with the blade attached with a stainless screw. For me it was no chore, I had a machine shop at my disposal.

To remove the crystals from the cell, I found one of those scoops used for removing litter from a cat's box worked quite well. It held the crystals without losing many of them, and allowed the electrolyte to drain adequately. The crystals were immediately washed with distilled water once removed from the cell, with the wash water making up the following batch of electrolyte. Crystals were placed in a large Buchner, which made washing easy. Once well washed, they were force dried in a large evaporating dish, with a low flame.

There's a template above the cell which was used to cut the fabric for the anode basket. You MUST use a bag, which becomes the collector of values that follow your silver. This is the process where you recover the platinum group of metals that follow silver, along with some gold, surprisingly. The cut fabric was sewed to form a square, which was held in place in the basket by the polypropolylene clips you see in the rather poor picture, below. The basket was made from 3/8" polypropylene as well, held together by stainless screws, and had a gridwork in the bottom that supported the anode. The gridwork was a series of ¼" poly rods with 1/8" sheet strips of poly, spaced with some ½" diameter tubes that fit over the ¼" rods, and between the 1/8" strips. Hope that makes sense.

I ran the cell in that location for about ten years. It's virtually impossible to handle the electrolyte without some splashing, and it stains everything it touches, as you'll see. The cell was fabricated from 304 stainless sheet material 16 gauge, and was TIG welded, then electropolished. You could just as easily use a large stainless container from a steam table, but it would involve some creativity in that you must have a basket that is non-conductive and inert, in which you place your anode. You'd also have to have an anode mold cast so it would be sized according to need.

Quote:

> Current density I am not sure of? My plating manual says 1 amp per 16 sq. in. of cathode and air agitation for decorative silver plating.

Voltage and amperage would be determined by the individual cell and its characteristics. Spacing of the anode/cathode come into play, as does anode size, as you alluded. I started out trying to run about 15 amps on my anode, which was, maybe, 9" square (don't recall the dimensions). It ran fine, but deposited fine, long crystals instead of short, compact crystals. They had a tendency to short the anode in only a couple hours. Considering I like to sleep through the night (the cell ran non-stop, and builds a temperature at which it is happy and runs best), I cut back on the voltage, with a corresponding drop of the amperage. I could allow the cell to run unsupervised for a few hours, so I could sleep through most of a night. I benefited by growing larger crystals in the bargain.

Again, each case will be its own. You could even allow the cell to sit idle when you're not there to tend it, but if you have much silver to process, you'd never get finished. I'd run my silver cell two or three times each year, but I ran a few thousand ounces each time I ran it.

Don't confuse silver refining with silver plating-----your objective is not the same. The current density, I think, is higher in parting.

I took the liberty to post a second picture, this one with a series of molds. The large one on the left casts a 100 ounce silver bar, the square one was my anode mold, and the cone mold(s) on the right were used for pouring buttons that came from melting silver, recovered from solution with copper, or from silver converted from chloride. It got a flux cover when melting to absorb any oxides that were present. The cone molds allowed a small surface area on the button from which the flux could be easily removed. Often, once cooled, a tap with a hammer was all it took. The buttons were then re-melted and cast as anodes. Note that the molds are all well blackened. Foundry supplies sell a mold dressing that I highly recommend. It's nothing more than lamp black prepared such that it can be brush applied. Without it, you'll get soldering of silver to the molds.

Quote:

> And Harold. I have allready copy & pasted a small book on your lessons here. Probably others have too. You allready have a good start right here for your book. Think about it.

Chuckle! If I keep posting, it will save you the cost of the book!

I'm highly unlikely to write a book, considering it would be a repeat of Hoke for the most part. I confess, there was a time when I had planned to do so, but realized early on that I was no writer. I've done one hell of a lot of posting since then (early 80's) and have since improved enough to at least make my posts make a small amount of sense. Hope you know that I'm highly flattered, though. It's been real good for my tired ego to have folks respond to my contributions.

Assuming I were to write a book, I could add more on silver, which Hoke tended to disregard, but otherwise I'm not convinced there's anything new I could add. You'll slowly come to understand why I am such a champion of Hoke's book----almost everything I talk about came from applying what was already in print. I've changed a few things, such as including the ammonium hydroxide wash to the cycle of cleaning precipitated gold, but not much more.

I've stressed the fact that Hoke was a master at presenting information in such a manner as to allow people like me to understand her instructions. My only disappointments are that the costs referenced in her book don't come close to today's reality, and she was really big on "tossing on the gasoline" when incinerating. It goes without saying that you should **NEVER** use gasoline in that manner. There are other means to the same end, that don't present the horrible risks.

Thanks for your support, Phillip.

Harold

I wrote the post below before I saw Harold's post but I wasn't able to post it yesterday. The traditional Thum cell I'm speaking of looks nothing like Harold's. When I first saw Harold's, I was taken aback, since it looked so strange. On closer examination, I can see what he had in mind. His cell eliminates the need for sliding the basket back and forth in order to remove the crystals. Also. the entire cell is the cathode and will probably last forever. Actually, pretty darn ingenious. At 10 amps, his cell probably produced about 20 to 25 ozs in 24 hours

Most books suggest using unbleached muslin as a filter cloth. I bought mine from Walmart and used a double thickness. It's only problem is that there's sizing in it and it takes an hour or two before the solution penetrates the sizing and there is maximum current flow. The cloth is used once. The muslin cloth also burns well. I never used only gasoline for burning but often used a safer 50/50 blend of gas and diesel.

The 30 gallon cell mentioned below consists of an flat bottomed outer tank about 30" X 60". It was made from 2" X 10" lumber with a 3/4" plywood bottom. It was coated with several coats of polyester boat resin. The last one I made was coated with PVC that was applied with a chopping gun. A sheet of 1/8" 300 series stainless laid flat in the bottom. The stainless had a 90 deg. bend at one end and protruded out of the tank in order to make electrical contact.

The inner basket (also coated) was about 28" X 28". The sides were 1" X 6" lumber. Instead of a solid bottom, there were 19 removable 3/4" OD PVC pipes sealed with pipe caps on each end. A length of 3/8" or 1/2" rebar was put into each pipe for rigidity. Each pipe rested on a support on the sides of the basket. The muslin cloth was laid on the row of pipes and the 21 impure silver bars (about 30-35 oz each - about 600 oz total) were placed on the cloth. The bars were all touching each other. The solution level was adjusted so it touched the bottom of the silver bars. To make contact to the bars, I used a 3#, 60/40 copper/silver bar attached to the power cable. This contact bar was simply placed on the silver bars. A protruding wooden crossmember was attached to 2 ends of the basket. They rode across the top sides of the outer tank and allowed the basket to be slid from one end of the tank to the other.

The drawing in the attachment is a cutaway side view of a standard silver cell.

I once made a 5 gallon cell, using a 7 gallon plastic tray as the outer tank. The stainless was the same as in the 30 gallon tank. The basket was made from one of those plastic carrier boxes, with diamond shaped holes, that are used to carry 4 gallons of milk. I cut off the top 1/3 of the basket and ran 2, 3/8" stainless rods through the holes in the basket. These rode on the top of the tray to support the basket. This little cell made about 75 oz. per day and worked great. It was very cheap and fast to build.

In both these cells, the size of the stainless cathode must sit very flat on the bottom. It must also fit fairly snug and the corners must be slightly rounded to fit without cutting into the tank coating. It must be professionally bent and professionally cut with a large shear.
.
The silver in the cell must be harvested at least every 4 hours. If allowed to run too long without harvesting, the silver piles up under the basket and shorts out with the silver bars. This invariably burns a hole in the filter cloth and allows all the grunge collected by the cloth to co-mingle with the solution. Then, the entire 30 gallons has to be filtered and the tank cleaned and re-setup. One doesn't make this mistake twice. If one has to leave for awhile, the power is shutdown or reduced.

To harvest the silver, the power is shut off and the crystals are pushed to one end of the stainless cathode. The basket is slid to the other end and the crystals are removed. I always used a stainless BBQ spatula, with no holes in it, to remove the crystals. The power is then turned back on. The crystals are filtered and rinsed very well. Then they are melted and cast into 9999 bars.

Yesterday's Post
Steve, I'm quite familiar with the Hunter patent you linked and I remember the interest it created when it was first released. It is not a patent for a silver cell but, it is a patent for removing the build up of copper from the solution, using solvent extraction. However, the cell solution parameters given (1.5 pH, 60 gm/l silver, 30 gm/l) are valid.

There are two basic types of silver cells, the Balbach-Thum (horizontal) cell and the Moebius (vertical) cell. The Moebius cell is usually used for large volume because it takes up less floor space and doesn't need the nearly 24/7 attention that a Thum cell needs, for maximum production. The Thum cell is easier to set up and use. Both are fairly complicated to build. At least, you have to understand what is required. The dimensions are fairly critical. A standard 30 gallon Thum cell will produce about 500 ozs of 9999 silver in a 24 hour period. The books don't come close to telling the entire story. Also, the info in the books is based on mining operations where the composition of the impure bars run the same, day after day. For us, running scrap silver that is different every batch, the situation is much, much more complex. To adequately cover this subject, it would take at least a 30-50 page report, with drawings. There are lots of ins and outs and lots of variables. Each metallic contaminant may require a little different approach.

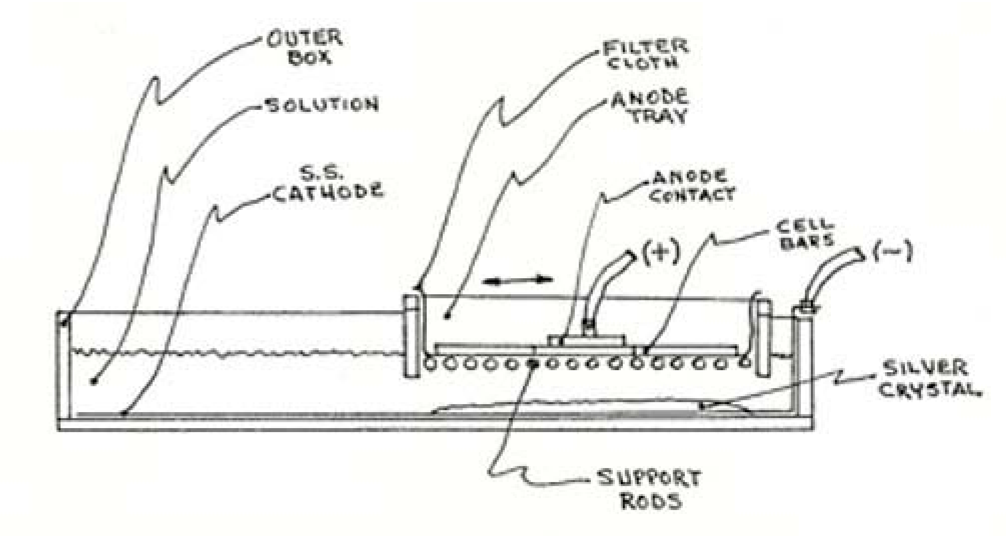
Just as aqua regia is the final purification step for much of the pure gold that is produced, the silver cell is what finally purifies the silver. With gold, there are other methods available besides aqua regia. To get pure silver, the silver cell is about the only game in town.

I got 5 years of hands-on experience working in a place that had 12 Thum cells and produced about 5000 ozs per day. Two of the cells were, what we called, breakdown cells. We used them to breakdown silver bars that contained lower amounts of silver. Instead of making up the starting solution with pre-mixed copper and silver nitrates, we started it with only a certain amount of nitric acid and water. As the impure bars dissolved electrolytically and silver crystal was produced, the nitric re-dissolved the crystal and formed the silver solution. This stuff isn't covered in any books.

In almost all impure silver, copper is the main contaminant. For example, sterling is 7.5% copper. As the bars dissolve in the cell, the silver plates out as beautiful loose crystals and the copper remains dissolved in the solution. When the copper dissolves, the silver content of the solution decreases. The copper goes up and the silver goes down. At a certain point of either, the crystal purity suffers. The standard way of solving this problem is to remove cell solution and replace it with silver nitrate solution that contains no copper. Thus, the great interest in the Hunter patent mentioned above. This system continuously removes copper from the solution.

Before even thinking about a silver cell, you must have a pot furnace with all the associated equipment, in order to produce bars from the impure silver: furnace; crucibles; tongs; molds; fluxes; safety equipment; exhaust; etc., etc. Also, you have to melt and cast the crystal.

You also need a variable rectifier to power the cell. For a full size 30 gallon cell, you need at least a 250 amp, 4 volt rectifier. You can run cells in series off of the same power supply (PS). A 250A, 12V PS (approx $2500) will run 3, 30 gal. cells. For smaller cells, the PS needs are proportionally less.



No heat. No agitation. Ideally, the starting solution should be 30 gm/l copper and 60 gm/l silver. You can fudge a little on this but, not much. The purpose of the copper is to make the crystal denser. Without it, the crystal will be fluffy and stringy and will climb all over and soon short out the electrodes.

For the copper, I would dissolve solid, clean (no solder) house wire in 50/50, nitric acid/distilled water. You can dissolve about 120 grams in 1 liter of 50/50 nitric. For the silver, use pure silver coins, US 90% coins, silverware, other types of sterling, etc. You can use US 40% silver coins but, not exclusively. You can also use silver that has been cemented out of nitric with copper, if there's no palladium in it and if it's been very well rinsed. Whatever you use, make sure that the only contaminant is copper. Many other metals will create problems. You can dissolve 420 grams of pure silver in 1 liter of 50/50 nitric.

When calculating the nitric needed for silver alloys, you'll have to take into consideration the amount of copper in the alloy (s), using the figures above. Also, when calculating the copper wire needed, consider the amount of copper in the silver alloys you're using.

After dissolving the metals, it is best to not have any free nitric left in the solution. It doesn't really hurt anything but, until it's used up, the silver crystal produced will be re-dissolved.

After dissolving everything, dilute to final volume with distilled water. Never use tap water in any part of this process. It contains chlorides and the silver chloride produced will create a cloudy solution and contaminate the crystal.

When the cell is operating, for every gram of copper dissolved in the solution, from the impure silver, the total silver content in the cell will decrease 3.4 grams. If the silver in the cell goes below about 15 - 20 gm/l or the copper goes above 100 gm/l, the crystal purity will be affected. Try to keep records and keep track of how much copper is being dissolved. Usually, you know this by the type of materials you are running. When the silver in solution approaches the danger level, you can build up the silver content in 2 ways.

First, you can calculate how much silver you need and add the equivalent amount of nitric acid. This will re-dissolve some of the crystals. This method will obviously cut into your production.

Second, you can remove some solution and replace it with silver solution that contains little or no copper.

When I ran cells, I analyzed the solution silver content with a simple titration method. One of these days, I'll post how to do it. Then, I measured the specific gravity of the solution with a hydrometer. From this info, I calculated the copper content using a graph I had created.

The impure silver you run through the cell should be at least 90% pure. Otherwise, the silver in the cell decreases so fast that you can't keep up with replenishing it. The easiest silver to refine in the cell is silver that has been cemented from a nitric solution and melted into a bar. It runs about 98 - 99% pure and the silver replenishment is not needed nearly as often.

At 100% efficiency, you will produce 4.025 grams of silver crystal per amp-hour. However, no electrolytic system runs at 100% efficiency. Therefore, at 5 amps, you produce about 20.125 grams per hour. It is best to not go over 4 volts. If you're using a battery charger, use the 6V setting. It may or may not work at 6V. The crystal density could be severely affected and the crystals may grow all over the place. Never use 12V. If you're handy, you could rig up an adjustable shunt, with a voltmeter, to drop the excess voltage.

When running vertically, the crystal will fall off of the stainless cathode and pile up on the bottom of the container. The worst thing that can happen is if this pile grows to the point where it makes contact with both electrodes and shorts them out. I would suggest that you use a 5" separation between anode and cathode. Keep the electrodes about 4" off the bottom of the container.

When the crystals build up to a certain point, you'll have to disassemble the entire cell and pour off the solution to collect them. A way around this may be to also bag the stainless cathode. Leave a couple of inches of empty bag below the cathode so there will be enough room to catch the crystals. If you use a bag, you'll probably have to figure a way to hold the bag a little bit away from the cathode surface. If you don't, the crystals may grow through the cloth. I've never used a bag for the cathode but, for some reason, I think this might happen.

Since you're running vertically, you'll need some sort of wire to suspend the electrodes. Stainless is the cheapest choice (gold also works). Just remember that stainless is only about 1/35 as conductive as copper. The wire should be heavy enough to not overheat. You can make S-hooks from the wire.

Vertical is not the best way to do this. I think that, after you read this, you will see that horizontal is best. It should be easy to design a very small horizontal cell. I once made a horizontal one, in a one liter beaker, for my nephew's science fair project. I"ll try to remember how I did it. It's been 20 years.

I love silver cells. They're fun and very easy to run, once you get setup and learn the ropes. Pure gold is about the most beautiful thing on earth. Pure silver crystals come in second.

Good Luck!   Chris

AP

I've processed many batches of small pins and sockets in excess of 5 pounds with great success using 1 gallon of HCl to 1/2 gallon of H_2O_2. The trick is to keep the solution light emerald green (transparent is best) and well agitated. The bubbler will work to keep the solution active, but not as efficiently as periodic small peroxide additions.

If the solution starts to form blue-green salts just add a cup or two of HCl.

Another alternative to your problem is HCl in the crockpot. It's cheap too.

One last alternative is to set up several smaller batches of AP to run in parallel.

Steve

Hey Harold

Harold or anyone that maybe able to clarify something for me.

If you use steel to recover the copper in AR solution. If there is any gold left in solution would it drop to the bottom or would it collect with the copper?

Harold in my case of the Witches brew I have. I put some angle iron in to drop the metals.

I submerged the steel and held it there for a minute it became copper coated pretty much instantly. So I drop it in and left it set for a couple of days. Went back and pumped off the top liquid to about 6 inches to the bottom.

On the bottom there was copper clumped together. Would the gold collect with the copper or would it settle out by its self?

I removed all of the copper clumps and let the fine powder type mud settle over a period of time. It is red and brown mud.

I ran the copper sludge through nitric acid and it seemed like there was very little gold flowing in the acid or settled on the bottom.

Could the gold be in the fine mud?   KY

Ky.Sam wrote:

> If you use steel to recover the copper in AR solution. If there is any gold left in solution would it drop to the bottom or would it collect with the copper?

Steel will precipitate copper, nickel, and all precious metals indiscriminately from solutions. It's a good way to recover small amounts of values, but is NOT a refining procedure because it is not selective.

If you have any copper that is not in solution and it's in contact with a solution that bears values, those values will precipitate on copper, also indiscriminately. That would include silver in a nitrate solution that might be contaminated with either Pt or Pd. While Pt is difficult to dissolve in AR, and impossible to dissolve in nitric, surprisingly, in the presence of silver, that is no longer the case. Those of you that use the inquartation process for refining karat gold will often encounter a batch that contains Pt or Pd, so your silver will carry traces of the Pt group. It is for this reason that anyone that processes karat gold should also make provisions to part silver with a cell, which is the easiest way to recover the Pt group metals.

Quote:

> Please read and clarify this if you can www.finishing.com/306/93.shtml

There is so much bad information in those posts that I recommend you ignore them. One of the glaring errors is the notion that you can create silver nitrate and melt it directly, yielding pure silver. While the concept is correct, the act of melting silver chloride in and of itself is in error. A reducing agent must be employed to effect recovery, and there was no mention of that. Soda ash acts as a reducer, but it is very hard on melting equipment, and is also not selective. Any oxides of base metals will be reduced along with the silver chloride, so the end product, while improved, will not be pure.

The best thing for you to do is ask a question about something that may be confusing you. I'll give you an answer that will be straight to the point, and explain why, assuming I'm able.

Harold

You may have created a bit of a monster if you have chlorides present when you dissolved the copper. In this case, you would have been very well served to incinerate the sludge before attempting any further refining. That would drive off any residual chlorine, so the nitric would attack only the base metals, not any gold, assuming you had any present.

When you recover values on scrap steel, even the resulting copper gets involved in precipitating the gold, platinum or other values. In the end, everything (of value) will have precipitated on the steel and the copper. You don't get selective precipitation by this method, it's strictly a bail-out to recover values such that you can start a different process instead of tossing them.

Armed with that information, it's clear that you can fully expect that the entire lot may contain values, not only the sludge in the bottom. The exception to that can be that the copper, as you noticed, first to precipitate, might be barren of values at one point along the way, but it's difficult to know when you are at that point. You should re-dissolve everything, but you will now be looking for very finely divided particles of gold and Pt, if there was any present.

Test the solution you have already made thus far to see if you have dissolved any of the values. If not, you're in good shape. Work all of the material you recovered on steel until the acid is spent, then take it up with water and allow it to settle well. A full day or more may be required. When you are comfortable that the solids that were in suspension have settled totally, decant the solution, being careful to NOT pick up any of the solids that are at the bottom. The crud at the bottom should be your values, minus the copper, which is now dissolved. If you find you still have undissolved copper, repeat the operation until the copper is all in solution. You now have eliminated the bulk of contaminants. If you really want to guild the lily, wash the residues well, decant, get them in a filter, dry, incinerate, wash in boiling HCL, rinse well, then dissolve in AR for selective precipitation. . The gold from this operation will be very clean, and will filter beautifully. The HCL wash after incineration eliminates all kinds of trash that make filtration difficult, and minimizes drag down.

If you're lost on any of this, ask for clarification. The procedure I just described is the one I used when refining gold filled materials. It works beautifully! 😉

Harold

A couple of weeks ago I took what settled out of my witches brew and ran it through Nitric acid. What didnt go into solution I washed with Hydrochloric acid. The acid turned brown. I set it aside for a few days and filtered it.

There is a thick brown sludge of particles on the filter. The remaining acid is dark brown. Nothing else has settled to the bottom of the container that the acid is in.

My question is will copper and iron and the like stay suspended in the Hydrochrolic acid?

For everyone to know what I am talking about when I refer to witches brew. It is real contaminated aqua regia. It contains all the metals that I put in the Aqua Regia.

Quote:

> A couple of weeks ago I took what settled out of my witches brew and ran it through Nitric acid. What didn’t go into solution I washed with Hydrochloric acid. The acid turned brown. I set it aside for a few days and filtered it.

I guess my first question is did you follow the steps I outlined when we started this conversation? If not, why not? What I told you was a sure fire solution to the problem, and should not have yielded different problems with the same questions. If you didn't follow the instructions as I gave them, I'm not the one to help you. Not sure anyone is. There won't be any magic cures to this problem unless you move to a furnace. You must follow the outlined steps if you expect results.

When you say you "ran it through" doesn't tell me much. If you got it wet, let is sit for a few minutes, then moved on, that's a huge mistake. It needs to be heated for proper results, or allowed to sit for several hours, if not several days, at ambient temperatures. Heating is the > >> key here.

Was there any incineration between any of these operations?

Did you boil the material in each acid, or just allow it to sit at room temp?

Did you use enough acid to dissolve everything that would with each acid? Could be all you've done is remove some of the crud, leaving the balance to still be a nuisance. These are questions that need to be answered.

Quote:

> There is a thick brown sludge of particles on the filter. The remaining acid is dark brown. Nothing else has settled to the bottom of the container that the acid is in.

Have you tested the solution since filtering to determine if there's any values contained within? If so, and you get NO reaction with stannous chloride (of known quality. Testing against a standard gold solution is a sure way to know), you can dispose of the solution at this point. There should be NO color reaction. If you get anything that resembles light colored coffee, or anything dark, it's questionable if the solution is barren.

Regards the brown sludge--if you haven't boiled the stuff in HCL, there's a chance it's nothing more than iron, but I hesitate to say. Gold that precipitates from dirty solutions is known to come down very dark, and often very fine, refusing to agglomerate and form large particles. You could be seeing very dirty gold. If it is, it's usually quite heavy, although if you have but a fine layer, that might be hard to determine.

Quote:

> My question is will copper and iron and the like stay suspended in the Hydrochrolic acid?

Neither of them have much reason to precipitate as far as I know (unless you shift the pH), but with the mess you created, I don't doubt the possibility of some strange reaction precipitating one or the other. I'd be inclined to think that copper would come down, not iron. Iron, if the solution moved away from a low pH, would likely come down as nothing more than rust, and would quickly dissolve in HCL. What I'm inclined to think right now is you haven't dissolved all the crud, or you're seeing very dirty gold.

Working with metals with cold acids isn't at all what I'm familiar with -----I did everything with heat-----and expect given reactions. When you avoid using heat, I may not be well informed on what to expect. Some of these reactions may take hours at room temp, where they are more or less instantaneous when heat is applied, and you can see the results of your efforts rapidly. I'm really struggling here, as you can see.

Best thing I can offer at this point is to incinerate the material you find in the filter (to a red heat, but do not melt), which will kill all the acids. I would then take a small sample and boil it in a little HCL and water. If you have gold, the color (of the solids) will improve, maybe it will even start looking like gold. Test the solution to see if you are dissolving any values. I would expect you would not. If everything goes into solution, and it's brown in color, I'd suggest you have a great deal of iron present----but if it leans towards reddish brown, or even mercurochrome colored, test for palladium. >>>

>>>>
If this test is not conclusive, take a second small sample and boil it in a little nitric and water. If you have gold, it should not dissolve, and the color should improve, depending on the nature of the contaminants present. I never recommend a nitric wash for precipitates, but if you kill the chlorides first, it's safe to do. This would all be so easy if I was standing at my old fume hood! It's really hard to know what to expect when I don't know how you've handled the material.

AP Advise request

Teabone,

By using the first method (peroxide acid) to dissolve the just base metals and not the gold, you will end up with a cleaner gold powder when it is dropped out of the second solvent (HCl-Cl or AR). As you have read time and time again on the forum, the purest gold is that which is first thoroughly cleaned of base metals, then dissolved and precipitated. A second cycle of cleaning and precipitation yields even higher quality gold. If you were to attack the gold and base metals outright using the acid peroxide bath the gold and copper laden liquid would drop gold when treated with SMB, but the gold would not be as pure as it would be if it was separated from the base metals first.

In practice you can remove the base metals with many techniques, including using the HCl-Cl to remove the base metal first. The idea behind using the peroxide acid to strip the base metals as a first step comes from the fact that the $CuCl_2$ formed from the acid peroxide attacking copper is a really good solvent for Copper coupled with the fact that the same mix is only a fair solvent for gold (1/45 the dissolution rate of HCl-Cl and 1/450 the dissolution rate of AR). In short, the acid peroxide ratio is such that it is meant to catalyze the formation of $CuCl_2$, not for the dissolving of the gold. By performing the acid peroxide reaction at room temperature, the likelihood that the gold will be dissolved is reduced even further.

This duality of function of the acid peroxide method is leading me to believe that I should modify it yet again to be the Copper Chloride method. This way it will clearly be tuned to attacking the copper cladding and not the gold. The new and improved method will have the added benefit of having zero acidic fumes. I'm still researching the best solvent for copper when safety, speed, efficiency, and reusability are factors.

Steve

Now that my first button has been achieved, I want to move on with a rather large batch of small pins and sockets, chopped and punched from wire-wrap pin boards (around 50 pounds).

My ponderings on the subject have led me to three possibilities: nitric boil - quick method - gallons of waste - this will break the bank; AP - gallons of waste and many weeks - low cost; e-cell - endless hours tending a basket plus the frustration of handling the small pins -very low cost and minimal waste production.

Regarding AP: What is the largest practical batch anyone has run? Is one and a half gallons of AP about right to process one pound of pins? Has anyone tried a fish tank bubbler to enhance the effectiveness of this method?

Any, and all thoughts are welcome - even ones of having my head examined.

Thanks everyone.

I've processed many batches in excess of 5 pounds with great sucess using 1 gallon of HCl to 1/2 gallon of H2O2. The trick is to keep the solution light emerald green (transparent is best) and well agitated. The bubbler will work to keep the solution active, but not as efficiently as periodic small peroxide additions.

If the solution starts to form blue-green salts just add a cup or two of HCl.

Another alternative to your problem is HCl in the crockpot. It's cheap too.

One last alternative is to set up several smaller batches of AP to run in parallel.

Steve

Mike,

Only add peroxide if the solution darkens considerably or the reaction stalls for an extended period. I only add 1/8 of the original amount of peroxide. The yellow color may indicate dissolved gold. Be sure to check your solution. With too much extra peroxide the solution is more likely to dissolve the gold.

Steve

BUYING KARAT GOLD

Catfish is probably the best member to answer your questions. Also, go to his profile and look at his posts, especially his earlier ones. He pretty well outlined his methods in these posts.

The pricing depends on who you're buying from and how much you're able to sell it for. If you buy from the public, the profit margin is much greater than if you buy from pawn shops, coin stores, jewelers, or other buyers. However, both are lucrative if you get your numbers straight. Buying from the buyers is lower margin but higher volume.

Although some would disagree, I think more money can be made on karat gold by simply buying and selling, without refining it. In my experience, the secret is to turn your money as often and as many times as possible per unit time. The refining process slows this down considerably. Also, by turning the metal fast, you are not as affected by daily changes in the market price. If you get to the point where you're doing big volume, that's when you MIGHT consider doing your own refining.

When I bought and sold karat gold, I sometimes quoted how much I was paying, per gram or pennyweight, for 10Kt, 14Kt, 18Kt, and 22Kt, based on a certain percentage of the market price. I never mentioned the market price - only what I was paying. These numbers change daily and sometimes hourly, depending on what the market is doing. You really have to keep on top of it. Another way is to keep silent about what you paying until you have evaluated and weighed the material. Then you say something like, "I will give you X dollars for this bunch of material." When buying from the public, they will usually take what you offer, unless they've been shopping around. If you quote on the low side, you can always negotiate and increase your offering price. A friend of mine, who owns a scrap metal yard, often says, "It's not my job to educate the public." When buying from buyers, they are more savvy and will often ask what you are paying for 10Kt, 14Kt, etc.

You can usually buy from the pubic at somewhere between 50% to about 80% of spot. If you buy from buyers, you will pay from about 80% to 90% of spot. Whatever the traffic will bear. When selling your karat gold, the price you can get depends on volume, the honesty of the buyer (or, refiner), how you have prepared the scrap, and how well you've covered your butt. When selling small amounts, you'll usually get somewhere between 93% and 98% of spot. For very large amounts, you might get over 99%. Always shop around when looking for a buyer. Also, don't forget that, when you buy, you're paying cash and, when you sell, you usually get a check. Catfish may disagree with these numbers. I haven't done this in awhile and different strategies are needed in different markets. As in all things, buy low and sell high but, don't price too low or, you'll price yourself out of the market. There is plenty of competition out there.

You will have to go through a learning curve on how to determine the karat of gold objects. Some gold is not marked and, even that that is marked can be marked wrong. Catfish tests everything, even if it's marked. This is a very good idea.

When I was manager of a refinery in Hong Kong, I once asked the owner of the largest Hong Kong gold exchange what he thought the gold market was going to do. He said that there were only 2 great experts in this field. One thought the market was going to go up and the other thought the market was going to go down. I have never forgotten this. In other words, when buying and selling, never worry about the market. Just make sure the proper buying/selling spread is present, on every deal, and turn your money as fast as possible.

This is only the tip of the iceberg and these things are only my ideas. I'm sure that Catfish can provide much more info than what I've given you.

Chris

Hunchback:

I just got back from buying some karat gold, and saw your post. Goldsilverpro has pretty well told you all the important steps in buying karat gold and also his recommendations on refining it.

I agree with him totally. I have been in this business for a little over two years of buying karat gold and reselling. First as Chris said, you don’t want to refine karat gold for there’s not enough money in it. I will give you my buyer’s name and web site that buys all my gold. He pays 98% world spot for all of it. First you will not get much more for your gold even if you refine it. It would have to be assayed if it has been refined, and then it would have to be at least 99.95% pure. Assaying cost money too. The difference is just not there, when you can sell it in karat form for 98%. You would have to have very large amounts of karat gold to even break even refining it and assuming you could get the required pureness and then find a buyer for pure gold.

Now as far as buying karat gold, you need to be fairly good at testing gold. Just because it is hallmarked as karat gold doesn’t necessarily mean that it is karat gold. There are as many dishonest folks in the precocious metals business as there are in the used car business. I test for visual hall mark stamp of karat gold marking. You have to watch, sometimes it will be marked 14k RPG, HE, GF, KGF, 1/10 12K or 1/20 14k.and other similar markings. When you see any of these markings, this tells you this is not pure karat gold. Don’t turn this type of gold down, for if you are in the refining business, this is the very best for refining. Only you don’t want to pay much for it. I buy gold filled gold items for about $9.00 per ounce. This is about 60% of the actual gold content if it is 1/20 GF, now 1/10 GF is more. I have developed a spread sheet that updates automatically every day in accordance to the gold prices at the

World and New York spot buy prices. I base all my buy prices at 60% of 30 day average spot prices. You don't want to buy on one day's spot price for the price of gold fluctuates from day to day. I like a running average of about 30 days.

As for as testing gold, this take a lot of experience and hands on. Just briefly how I do it is I put all the scrap in a pile and take a cheap magnet and go through it. This will separate all ferrous from the non ferrous metal. I then take the remainder and check it with a 10 X jewelers loop for hall mark stamp. Identify all pieces as stamped and non- stamped. I then take the non stamp pieces and test them with an electronic gold tester. (This test sets works on a capacitance effect of the gold.) I put all the gold in different groups. As stamped rating and tested rating. I then tell the customer that if these items test for the amount of actual gold as stamped or tested, that I will give them so much money for in cash. Always try to keep your dollar amount offers in total amounts. This is a buying technique. Just the opposite as selling techniques by keeping your selling amount separate and in smaller amounts. (Part of the game).

After a tentative agreement with seller I then take a small rat tailed file and file a notch at least 1/16th inch in the metal. I then take nitric acid and test it for gold pureness. If it is gold plated, rolled or filled it will show up in this test. As I said before, you may still want to buy this gold that tests as gold filled or plated but at a different price.

At the present time I am paying about $400.00 per ounce or $20.00 per penny weight for pure gold. You want to keep your numbers simple and round off if you can. Remember that I said before that I have a spread sheet with all the numbers. The customer is only interested in how much is it for 10k, 12k, 14k and 18k per penny weight/ounce. The spread sheet does all this for you.

If you are serious about this, PM me and I can send you a copy of my excel spread sheet and all the testing info you will need and the equipment also. You can get in to this business with very little capital. The most important thing is to be able to test the gold accurately. You make one bad deal for gold that is plated or filled, and you lost your entire profits for the next three good buys.

Hunchback, as you can probably already tell, I am a numbers guy and when you can turn your money over fast and clear 40% profit, you will do good. Grocery stores only make 2 to 3% on their money but the key is to turn it over fast many times. If you PM me I will also hook you up with my buyer too. They are a small recycler in Dallas Texas and very reputable. My son has been dealing with them for many years and I have for over two years my self and have never had any problems. I always know exactly how much gold I send them and what to expect. It has worked out perfect every time.

I know this is lot to digest, but I strongly suggest you study this business and become very proficient at it before you sink a lot of money into it.

I just bought $164.00 worth of Karat gold this morning, from the same lady I bought $71.00 yesterday. Not bad for about an hours work to make about $140.00. Once your customers learn they can trust you they will call you back and refer you to their friends.

Lots of luck

Catfish

Added
I buy from private individuals at 60% and sometime from pawn shops, but usually at 75%. I make more money from private individuals, but as I said earlier you can get larger amounts from the shops. Some times I buy several ounces from a pawn shop and send it to Dallas the next day. I usually send 5 to 10 ounces of pure gold or 10 to 20 ounces of karat to buyer. They will take any amount, but you got to take into consideration the shipping and insurance cost. This can add up.

White crystals in AR bottom?

GOGO:

Low temp causes that. No problem, just put it on hot plate and heat up to about 120 to 150 degrees F and it will disolve. then you can neutralize it and drop the gold.

You may want to keep the AR in a warm location to keep this from happening.

Catfish

Gold Refining Community

AR

Here are some chemistry lessons: 😈😈😈

Any solution containing chlorine ions is capable of dissolving gold.

Oxygen from the air can get absorbed into HCl and oxidize gold. The gold ions then form complexes with the chlorine ions to give auric chloride.

The truth is a very tiny amount of gold will dissolve in HCl until all available oxidizers are used up. This amount may not be detectable.

Acid peroxide is just a weak form of aqua regia. Aqua regia works by having the nitrate ion oxidize gold as ions and allowing chloride ions to form complexes. This is why you don't need nitric acid to make a gold dissolving solution: just use sodium nitrate (which is an oxidizer) for poor man's AR. Those brown fumes come from the nitrate ions being reduced by the gold as the nitrate ion gives up oxygen to become NO.

Acid peroxide is the same idea. Instead of nitrate as an oxidizer, you're using hydrogen peroxide, which is also a powerful oxidizer. The hydrogen peroxide oxidizes the gold and the chloride ions form soluble complexes. Also happening is the dissolution of oxygen into the acid, which helps dissolve gold.

Nitric acid will actually dissolve a tiny undetectable amount of gold into ions, but since gold will not form soluble compounds with the nitrate ion, the gold does not continue to dissolve.

The reason why nitric acid will dissolve base metals such as copper very fast while hydrochloric acid will not dissolve it fast is because HCl is a non-oxidizing acid.

HCl cannont oxidize copper metal into an ion so the copper stays intact. It will react with oxides of copper forming water with the oxygen and hydrogen ion leaving a copper ion to form a compound with the chloride ion. If there is oxygen in the air that can dissolve into the acid, then that dissolved oxygen can oxidize the copper which then forms compounds with the acid. In effect, the acid makes the copper corrode from the air faster because the chlorine is stripping away the protective oxide layer.

Nitric acid is different because it can oxidize copper. The nitrate ion plays a dual role. Free nitrate ions give up oxygen to oxidize copper. The oxidation of copper simultaneously reduces the nitrate ion into nitrogen monoxide gas. Free hydrogen ions combine with oxygen to form water and free nitrate ions combine with the copper ion to form copper nitrate.

The reason why AP is prefered over AR is because it doesn't give off horrible fumes. Gold is least likely to dissolve in both AR and AP, but each metal does not dissolve precisely sequentially. There is some overlap. Galvanic action can help make the process more sequential, but not everything is electrically connected so it doesn't happen effectively.

You can in theory dissolve base metals only with aqua regia by controling the amount of nitrate ions you put into the acid. The reason why AR dissolves everything is because we make it such that it will dissolve everything, but if we limit the amount of nitric acid or NaNO3, then we mimick the effect that acid peroxide does.

AP will dissolve everything like AR does if and only if you put in wayyyyyyyy too much peroxide without diluting it too far. It will take a long time but it will happen.

When an AP batch is done, the reason why gold flakes remain is because the oxidizer is all used up, and gold chloride displaces base metals and gets deposited as a black powdery film.

MEOW Astro,
Excellent description of the processes.

I try to think of the chlorine as the "active ingredient" that dissolves the gold. Without it you can't form the soluble Auric Chloride. The oxidizer can be any chemical or even electric current. The chlorine can also be produced from a chloride compound such as sodium chloride. The trick is to generate the in situ nanscent chlorine ion (Cl-).

Great stuff Astro!

Steve

Gold Refining Community
Gold Refiners helping one another !

Quote:

> 2.) I can get my hands on Nitric Acid and HCL to make true AR, but again don't know how much to mix up for a given amount of gold?

For average of 12Kt gold, shotted fine, figure on about 120mL of Muriatic (HCl) and 25-30mL of nitric acid total per troy oz. of karat gold.

Quote:

> 3.) The Cell, how much gold can be processed by Sulfuric acid in the cell before replacing? (I presume this one might vary and that one should just watch for the reaction to fade out)

Hard to say. I've run 1000's of ounces through the sulfuric and haven't thought much about it's capacity. There are too many variables in play. I would guess at 2 ozs. per gallon. It only stops working when the amps don't go to zero after the gold has stripped. This means that the black gold floating around is causing a partial short between anode and cathode.

Quote:

> 4.) Nitrate soak prior to AR for lower Karat gold? How much nitrate to how much gold.

This must be hot. Use 50/50 nitric acid. It only works on 10KT or less. For 1 oz of 10KT, figure about 70mL of nitric and 70 mL of distilled water. HOT.

Quote:

> 5.) How many gram of Sodium Metabisulfite is needed to drop X grams of gold?

If there's any active nitric left, it will take a lot of SMB. If no free nitric is there, you can probably drop 1 to 2 ozs of gold with 1 oz of SMB.

Quote:

> 6.) I got a price for Stannous Chloride $202 for 500gram. This is from a chemical supply company in Vancouver, Canada. Pretty expensive? How much do you usually need to check for gold left in solution? Are there other places to purchase this stuff?

Here's 454 grams, a lifetime supply, for $20, including shipping. I usually use a very small amount on the tip of my knife per test. Keep it sealed good.
EBay link

Quote:

> 8.) Question about pH. I've read a few posts about the importance of addiing Urea until you acheive a pH of 1. Once you acheive this state add the Sodium Meta? What is the pH before adding the Urea (0.1)?

Before adding urea, the AR pH is right at zero. If you add too little urea, all of the nitric won't be made inactive and you will use a lot of SMB. If you add too much, junk starts precipitating and the gold purity won't be as high. A pH of 1 is the best indicator that you've added the right amount.

Chris

Welcome to the forum and thank you for the post. Here goes my best shot at your questions:

Tilly wrote:

> 1) Poor mans AR (HCL with Sodium Nitrate) - how much AR (ml) does one prepare to produce 30 grams of gold (24K) (ie 52 grams of 14k = 30 grams of 24K.)
>
> I do have a ratio from Catfish on this one already about 1.5L of AR to process 48 gram of Karat gold)
>
> 2.) I can get my hands on Nitric Acid and HCL to make true AR, but again don't know how much to mix up for a given amount of gold?

--

Four parts HCl to 1 Part HNO_3,; If I remember correctly, Hoke states 4 fluid ounces of HCl + 1 fluid ounce HNO_3 to 1 troy ounce gold scrap.

Tilly wrote:

> 3.) The Cell, how much gold can be processed by Sulfuric acid in the cell before replacing? (I presume this one might vary and that one should just watch for the reaction to fade out)

- The acid can be used until it is saturated with black gold powder. I use a typical time frame of 12-24 hours of operation before cleaning. Let the powder settle, pour off the bulk of the acid for reuse, and dilute the remaining acid and black powder with water.

Tilly wrote:

> 4.) Nitrate soak prior to AR for lower Karat gold? How much nitrate to how much gold.

--

Actually, this is based upon amount of base metal to dissolve as gold doesn't dissolve in nitric. Hoke states 4-6 pounds of concentrated nitric acid per pound of dissolved metals (pgs. 42-43). GSP states 1/2 gallon 70% HNO_3 + 1/2 gallon H_2O for each pound of base metal (copper, etc.). Silver/Base metal content should be 75% minimum base metal or silver (preferred) to 25% gold or less. If only silver is alloyed with the gold less acid is required.

Tilly wrote:

> 5.) How many gram of Sodium Metabisulfite is needed to drop X grams of gold?

I have read some guys use 2 grams of SMB per gram of gold expected. I personally mix a saturated solution of SMB in water (65 gm/ 100 mL) and add until the solution no longer test positive for gold with stannous chloride. If using AR nitric must be neutralized before adding SMB or gold won't drop.

Tilly wrote:

> 6.) I got a price for Stannous Chloride $202 for 500gram. This is from a chemical supply company in Vancouver, Canada. Pretty expensive? How much do you usually need to check for gold left in solution? Are there other places to purchase this stuff?

--

Just make your own when you need it. Tin metal dissolved in HCl with heating. Won't keep very long.

Tilly wrote:

> 7.) I haven't been able to find borax. Can someone point me to the right isle in the grocery store?

--

Walmart Laundry detergent isle '20 mule team borax', blue-green and yellow colored box.

Tilly wrote:

> 8.) Question about pH. I've read a few posts about the importance of addiing Urea until you acheive a pH of 1. Once you acheive this state add the Sodium Meta? What is the pH before adding the Urea (0.1)?

--

Never checked it. Add until no more fizzing. Catfish and/or GSP probably know.

Excellent questions. I'm going to add the answers to my Reaction list where appropriate. 😉

Steve

tom341 wrote:

> I know the gold is there, now how do I get it BACK? (From the AR solution trash ?)

I managed to miss this response until tonight.

Is it safe to assume the gold is no longer in solution? Does the solution test barren?

Assuming it does, what you might be wise to do is to put everything back in solution, then use some copper to drag down the gold. That will recover the gold (which will still be in need of refining), and leave behind all the base metal that's your problem.

Use enough AR to dissolve the precipitated gold. Heating the solution will be very helpful. Once dissolved (and cool), filter the solution, then place it in a glass container and insert a small piece of copper. Don't use a plastic container----it's too hard to get the cemented gold off the plastic. A piece of copper wire will work fine---but the small surface area will make the process go slowly. The more surface area you present to the solution, the faster you'll recover the gold, but remember that the gold will coat the copper pieces, so you'll have to treat the copper to recover the gold. It's best to use a small amount and allow it to work for as long as it takes, reducing the copper in the process so you have only a small amount to treat afterwards. If it consumes it totally, add a little more. Do this until the solution tests barren of gold. If you see bubbling around the wire afterwards, allow the copper to remain in the solution until it stops. It's possible for the gold to re-dissolve if you have traces of AR present. It will continue to consume the copper, preventing re-dissolution and eliminating the acid. Add copper until you see no more action. Remove any remaining copper, and if it's covered with a black deposit, place it in a small beaker and add a few drops of nitric. The black is probably gold, which will be liberated from the copper when exposed to nitric. The black powder from this container should be added to the balance of solids, and dissolved in AR. You now have eliminated the majority of base metals, and have your gold concentrated in a small volume of solution.

It's a good idea to wash the crud well before re-dissolving in AR. Tap water is fine, but don't add any acids----there may still be enough residual AR to dissolve some of the gold. Test all your solutions before discarding.

Got it?

Luck!

Harold

Let me guess; Just a few pins, and they were not dissolved, just stripped, right?

If you're recovering gold from metallic objects with AR, you're not using good judgment. Here's what happens: When the AR is fresh and full strength, gold is dissolved----but as the solution weakens, gold then starts to precipitate on the un-dissolved base metal that is present. It won't look like gold, just like black mud, or maybe even dark brown. Unless you continue with AR until all the base metal is dissolved, you will never effect a full recovery because the gold will continue to precipitate on the remaining base metals.

Having commented on that idea, here's another: What little gold you managed to dissolve was precipitated. That's the reason you got a purple reaction. What you're seeing is colloidal particles of gold-----precipitated from an almost barren solution, too low in concentration per volume for the gold to agglomerate and form crystals. The gold is not lost, but will be a challenge to recover. You can allow the solution to sit for days and see little change, although it will stratify and slowly descend to the bottom of the container. You'll not be able to do much with it, however. Best to put it back in solution with AR once it's all on the bottom. Be patient! 🙂

My money says the bulk of your gold is where the pins are. Stop trying to strip with AR----and get rid of the base metals, or use a stripping cell.

Harold

I don't use the name "aqua regia" when talking about HCl and sodium nitrate. To me, aqua regia is HCl plus nitric acid. The two systems are very different in power and speed. With HCl plus sodium nitrate, you have contaminated the solution with a lot of sodium ion and have diluted it with all the water that is needed to first dissolve the sodium nitrate. These things zap it of a lot of it's strength. On the other hand, real aqua regia is full strength and will go after the metals with much more vigor. Using HCl plus sodium nitrate is probably fine on plated materials or gold powder but, for bulky gold alloys, such as karat golds, you need the power of real aqua regia. Sounds like a detergent commercial.

Toadiesop, if you put 18KT in boiling nitric acid for 5 years, it would never touch it. The ring would still be a ring that you could wear and it would still be as bright and shiny as the day you put it in. The nitric doesn't attack the gold but only base metals. In 10KT gold, the gold is only 40% and this lower amount will allow the very hot nitric to penetrate and attack the base metals and silver. This leaves only the gold, as a porous gold powder. With 18KT, however, the gold content is 75%. The gold is so high that it forms an impervious barrier and prevents the nitric acid from penetrating at all.

Aqua regia is a totally different animal than nitric. It actually will dissolve every type of metal involved, including gold and silver, in the alloy. It makes no different what karat the gold is. However, the dissolved silver immediately combines with the chloride from the HCl to form silver chloride. The silver chloride forms a crust on the surface of the karat gold and slows down the penetration of the aqua regia. If the silver content is high enough, the penetration of the acid completely stops. This problem is solved by inquarting with enough silver (preferably) or copper to reduce the gold content to 25%. Then, everything but the gold can be easily be dissolved in hot nitric acid. The remaining gold powder is then easily dissolved in aqua regia.

Hope this answered your questions.

Last edited by goldsilverpro on Sun Apr 29, 2007 6:59 pm; edited 3 times in total

HCI

Just to test theory I am soaking about a teaspoon of header pins in 3oz of hcl and 1 oz of peroxide(3%), with no heat I know this will take a while. my question is will this dissolve any gold after all other metals are gone? If it does can it be percipitated with smb.

Does it make a difference if the peroxide is added in smaller amounts more frequently.

I have a few other jars of the same solution with different types of pins, and contacts as not to mix materials

Welcome to the forum,

Excellent strategy!!! I like the way you think.

The ratio you specified of 3:1 is not what I recommend, but it's not a bad idea. The lower concentration of peroxide will have a much harder time dissolving any gold so that shouldn't be a problem until you pass the 2:1 ratio with peroxide additions (Acid:Peroxide). If you keep the temperature at room temperature (25 C)you shouldn't have any gold absorbed.

Any absorbed gold will readily percipitate using SMB. It's a little harder to see the percipitation with the dark green color of the solution, it will appear as a slight darkening of the solution within minutes of adding the SMB. After about 30 minutes or so you'll start to notice the bottom of the beaker getting a dark tint to it, that's the gold dropping to the bottom. I wait overnight before pouring off and rinseing.

Keep us posted.

Steve

THALLIUM.

Thallium is a rare metal, found in small quantities in some varieties of iron and copper pyrites, and in some lithia micas. It resembles lead in appearance. Its compounds resemble the salts of the alkalies in some respects; and, in others, those of the heavy metals.

It is detected by the green colour which its salts impart to the flame. This, when examined with the spectroscope, shows only one bright green line.[Pg 220]

It is separated and estimated by dissolving in aqua regia; converting into sulphate by evaporation with sulphuric acid; separating the second group of metals with sulphuretted hydrogen in the acid solution, boiling off the excess of the gas; nearly neutralising with carbonate of soda; and precipitating the thallium with an excess of potassic iodide. On allowing the liquid to stand for some time a bright yellow precipitate of thallous iodide separates out. This is collected on a weighed filter; washed with cold water, finishing off with alcohol; dried at 100° C., and weighed. The precipitate is thallous iodide TlI, and contains 61.6 per cent. of thallium.

Electromotive Series

This is a short electromotive series list that only contains the common metals. The list could be expanded to contain every element and alloy.

The rule is that a metal will drop out of solution any metal below it in the list. The metal used also must be soluble in that particular solution. The metal used actually trades places with the metal(s) that it is dropping. It dissolves into the solution and the other metals drop out, as metal powders, usually. The metal will not drop out any metal above it or, itself. The general dropping out process is called cementation.

For example, you have an HCl solution containing copper, nickel, gold, and palladium. You can first drop out the gold and palladium using metallic copper. The copper will not drop the dissolved nickel or copper. After collecting the gold and palladium, you can use aluminum or iron (steel) to drop out the nickel and copper, as metallic powder. The end result is much less toxic.

The greater the surface area of the metal, the faster the other metals will drop out of solution.

Sometimes, the metal doing the dropping gets completely covered with the metals being dropped and, the reaction slows down. Scrap it to expose fresh metal.

If you drop silver from a nitric acid solution containing excess nitric acid, using copper, the excess acid will, at first, only dissolve copper. When the excess acid is used up, the copper will start cementing silver.

Here's a simplistic way of looking at the EM series. The metals at the bottom want to be metals. The metals at the top don't want to be metals - they want to be metallic compounds. In nature, gold is often found in metallic form, copper is sometimes found in metallic form, and aluminum is never found in metallic form. A long time ago, aluminum metal was more valuable than gold because no one could reduce aluminum compounds to aluminum metal, except in small quantities, at great expense. They used such super powerful things as metallic potassium to do this. It was so valuable that some king or queen (British, I think) had a crown made from aluminum.

http://en.wikipedia.org/wiki/Aluminum

Magnesium
Aluminum
Zinc
Chromium
Iron
Cadmium
Nickel
Tin
Lead
Hydrogen

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Copper
Silver
Palladium
Mercury
Platinum
Gold

Gold Content of Scrap Items Series: Slotted CPUs

This is my second installment in a series of posts detailing the yields of harvesting various scrap items.

This installment in the series will show the yield data on Slotted CPU Fingers from processors as seen here:

I determined this information based upon 48 pounds of slotted cpus weighed without heatsinks or plastic housings.

Here's the two boxes of the slotted cpus after the fingers were removed: >>>>>

>>>>>>>>

The CPUs shown above are PIII slotted cpus. Thirteen of these cpus weigh 1 pound and produce 34 grams of clean cut fingers. The cpu cores do not easily remove like the PII's, so they will remain with the cpu board for future processing.

The CPUs shown above are PII slotted cpus. Ten of these cpus weigh 1 pound and produce 26 grams of clean cut fingers. The cpu cores easily remove and will be saved for future processing. A shot of the PII cores is shown below

Here's the 1347.5 grams of fingers cut from 48 pounds of slotted cpus:

The baggie weighs 12 grams so the actual finger weight is 1335.5 grams.

Now for the reaction information:

The 48 pounds of slotted cpus yielded 1335.5 grams of fingers. The fingers were processed in a mere 20 hours using rejuvenated AP. The AP was left over from processing the ISA fingers as seen in the AP video. It was rejuvenated by bubbling air thru it until the color turned transparent light green before adding the slotted cpu fingers. Air bubbling was continued during the etch process in addition to manual agitation.

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Here is a shot of the etch in process:

The resulting foils were washed as usual and then dissolved using HCl-Cl. The foils required 3/4 cup of HCl and 1/4 cup of clorox to fully dissolve. The pure gold mud was rinsed three times with hot tap water after precipitating with SMB. Here is a shot of the gold button produced:

The button weighs 6.5 grams.

Finally the yield data is as follows:

(454 * 6.5) / 1335.5 = 2.21 grams Au per pound of slot 1 cpu fingers.

From this the yield data per pound of slotted clean cpu cards is :

6.5 / 48 = 0.1354 grams of Au per pound of slotted cpus without heartsinks or plastic housings.

and lastly average yields for slotted cpu is :

0.1354 / ((10 + 13) /2) = 0.0118 grams Au per CPU

My next installment will show yield data for medium grade header pins from 28 pounds of boards.

Your comments and questions are welcomed.

Steve

Hey Mike:

Let me see if I can weigh in on this.

One pad is 2mm x 5mm+10 sq mm

10sqmm = .0155 sq in. per pad.

Each board has a total of 49 pads on each side for a total of 98 pads per bd.

.0155sq in x 98= 1.519 sq in per bd.

Today’s price of gold is 672.70 per oz.

.672 x 1.519 x.30=.306 or roughly 31 cents per bd.

214 bds x .31= 66.34/21.63 per oz of gold = 3.06 grams gold per Silverpros method.

My method is as follows:

10mm=.0155sqin X 98=1.519sq in per bd

214 bds x 1.519=325.066sq in at 30 u in thick would be .00975 cu in of gold

.00975 sq in = .1598 cc
19.3 grams per 1 cc= 19.3x.1596=3.08 grams of gold if the pads was 30 micro inches thick

If they were 20 micro inches then the expected gold yield would be 2.05 grams

It appears the gold thickness is about 25 micro inches

Catfish

Hmmm... so it comes out that each finger is worth about 25 cents....

The last time I sold scrap metal, computer cases were worth $70 a ton. That works out for the steel to be worth a little more than 3 cents a pound. If a single computer case is 10 pounds (the number varies, and 10 is an estimate), then each computer case is worth 30 cents....

As an estimate, it took about 550 slot processors to produce $135 of gold. If those 550 computer cases were 10 pounds of steel, then you'd have 5500 pounds of steel, which is worth $192.50 at $70/ton .

Hi William:

I just got back from my normal Saturday morning yard sales run. I hit seven yard sales and purchased the following gold items.

Gold price to day is $672.00 or 21.60 per gram my sell price 98%= $21.17 per gram
Cost Sell
53.4 grams of 10 karat gold jewelry at $5.36 per gram total $286.22 $471.41

1.4 grams of 14 karat gold jewelry at $7.50 per gram total $10.50 $17.28

9.1 grams of 18k 1/10 gold filled watch at $3.38. Total $3.38 .68g=14.40

91.0 grams of heavy gold plate (HGE) Jewelry at 1% total $11.70 1.0g=21.17

24.2 grams of .925 silver at .35 per gram total $5.42 $9.90

Estimated total profit on this one buy is about 534.16
-317.22

$216.94

Please note that I will have to refine the gold filled and plated stuff. I get 90% spot for all my silver as long as it is .925.

I also made one more purchase of old gold filled glasses from a flea market.

I bought 11 pairs of gold filled 1/10 12 karat glasses frames. I don't know the exact weight but I paid $2.00 per pair. I have been getting on the average of about $8 to $9.00 worth of gold from one pair average. I expect to clear about $75.00 on the glasses.

I purchased all the gold and silver items at 60% today's 30 day running average 0f $666.50 per oz. except the glasses. I just made the lady an offer. I was prepared to go as high as $5.00 per pair. As my good friend Harold sez "A deal is a deal".

You mentioned that you still had concerns on selling your gold. I talked to my buyer and she said that if you wanted to call her that would be fine and she herself would tell you what you would get. William, I must caution you again, when you sell gold, it has to produce the expected amount of gold per karat. In short, if the gold is solid karat gold it will produce the expected amount. If you don't want to do that, then I will be happy to buy all the gold (providing it is pure karat gold) you can sell me at 90% spot of 30 day running average. I will then resell to my buyer at 98% daily spot.

Seriously if you want me to help you on this just say so. I don't mind. I enjoy it and it is a wonderful hobby. Buying and selling gold is about as much fun as refining gold.

Catfish

Hey guys:

I have just finished up a batch of gold that started out looking bad. It was black, very fine and spongy. I used the method that Harold has outlined in this post on purifying gold. I am waiting on some new cupels to melt it.

I followed all the steps as far refining in AR, boiling in Hydrochloric for 5 minutes, rinsing, then boiling in water for 5 minutes, then rinsing, boiling in Ammonium Hydroxide for 5 minutes, rinsing, boiling in water for 5 minutes, boiling in Hydrochloric again for 5 minutes, rinsing, and boiling for 5 minutes in water. After all this I put it back in AR again and redid the entire process.

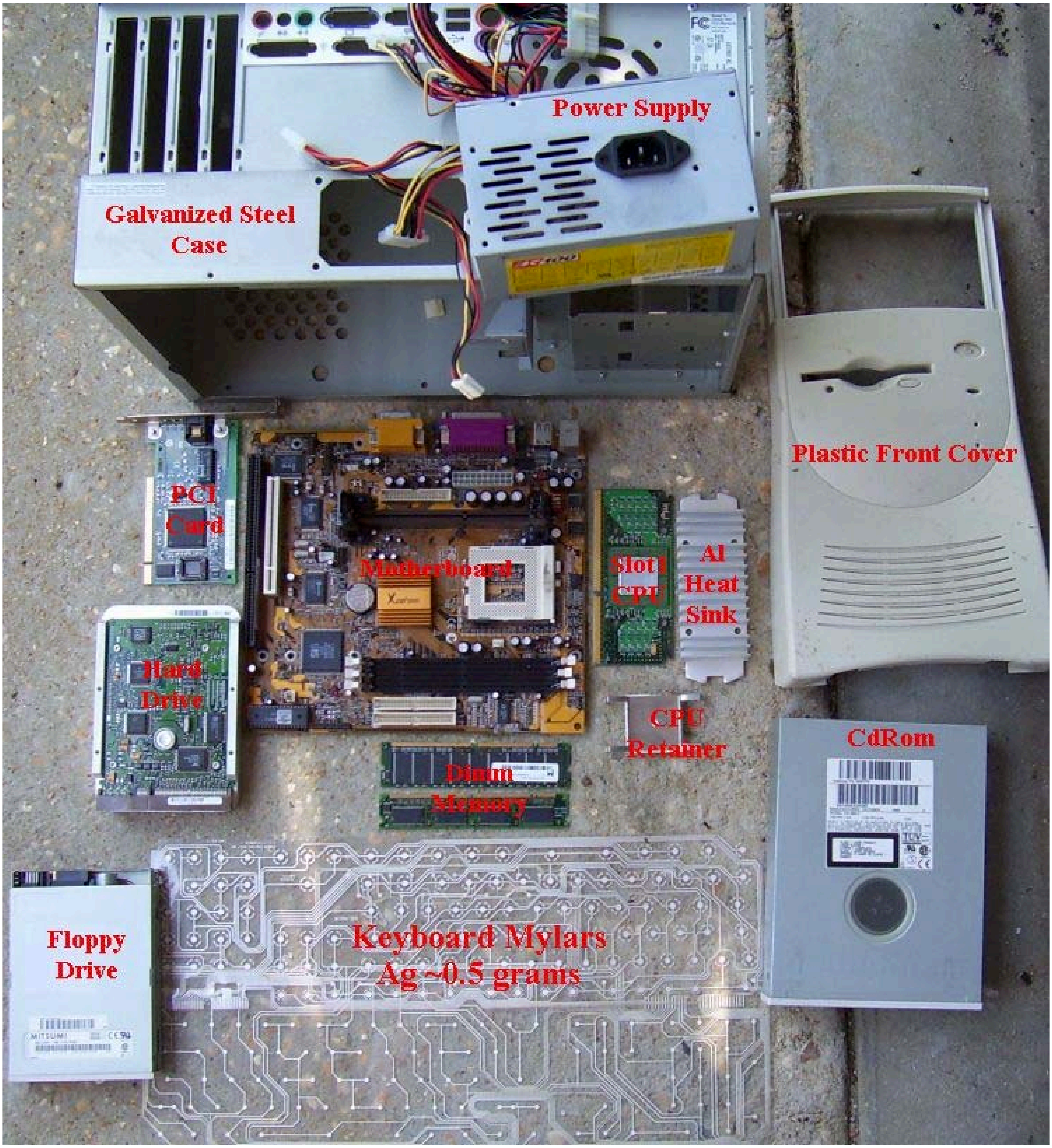
Attached is the finished product. Notice the gold is very light brown, clings together, and falls very fast in water. When I get it melted, I am going to send it to my gold buyer and have it assayed. I think it will turn out good.

Please note, the gold is still in water when I took the picture.

My many thanks to Harold and his fantastic knowledge and him sharing it with us.

My hat is off to you, Harold.
Thanks, catfish

Gold powder after precipitation



What to recover

Here's the exploded view of a Slot 1 pc with the various parts labeled:

And a quick listing of metals for each item:

a. Case= Galvanized Steel
b. Power Supply

  1. Housing =Galvanized Steel
  2. PCB=Various Metals in Components: Tantalum, Silver, Tin, Copper, Aluminum, Gold, Palladium, Nickel, Ruthenium, Lead, Silicon

c. Front Cover= Plastic
d. Motherboard, PCI Card, Floppy Drive, CdRom, Hard Drive, Memory Stick=Various Metals in Components: Tantalum, Silver, Tin, Copper, Aluminum, Gold, Palladium, Nickel, Ruthenium, Beryllium, Platinum, Lead, Silicon

  1. Header Pins= Gold, Nickel, Copper
  2. Card Fingers=Gold, Nickel, Copper
  3. Platters= Cobalt, Platinum, Chromium
  4. Card Sockets=Copper, Beryllium, Gold
  5. Hard Drive Housing= Aluminum
  6. CdRom Drive Housing= Galvanized Steel
  7. Floppy Drive Housing=Galvanized Steel

e. CPU Heat Sink= Aluminum
f. CPU Retainer= Spring Steel
g. Keyboard=Plastic Housing, Neoprene Buttons, Mylar Sheets printed with silver.

This is just a quick overview and requires more detail to point you to the exact quantites, but you get the idea.

Steve

You've got what are called Pentium 200 MMX cpus. Most guys just call them fiber cpus because they are made from layers of laminated fibers. The heat spreader (silver plate on top) is copper plated with nickel. It comes off easily with a heat gun to expose a square of gold plated copper foil. The pins are kovar, a nickel gold alloy. The core can be punched out as seen in my MMX core removal video on my website. The wires connecting the core to the housing are hair fine gold.

Steve

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FINISHED.

I started writing this before Harold's excellent post. In refining, for each type of material, there are probably at least 6 different methods of doing things. These are good, bad, or stupid.

Please note that both Harold's way and my way have been proven to work. It is best to learn every way of doing something and, then, you can think about what is the best way for you, based on the equipment you have, turnaround time, cost, profits, efficiency, safety, etc. I hate to admit this but, if I ever refine karat gold or platinum group from jewelry or dental, again, I will adopt some of Harold's techniques and incorporate them with mine. I only hope that he has learned some tricks from me, on things like the sulfuric cell.

Did you use real nitric or sodium nitrate?

There is always platinum (from .5% to 8%) and palladium (from .5% to 2%) in dental gold. The amateur looks at the high numbers. The pro looks at the low numbers.

The Main Problem -Silver

Quote:

> I thought all nitric was gone as there were still undissolved appliances at the bottom.

The silver in dental alloys can be quite high (3% to 24% - the average is about 12%). If the silver percentage is over 10%, it becomes very difficult to dissolve all the gold in AR. Silver chloride forms and it coats the gold. This is probably the gray color you now see on some of the metal. The silver chloride stops the action and that's why you thought there was no nitric left. From here, everything snowballed. It takes both hydrochloric and nitric to dissolve gold. If EITHER acid has been used up, the action will stop. So, excess metal on the bottom does not necessarily mean that all the nitric is gone. It could mean that the hydrochloric is all gone and there's still excess nitric.

You should of inquarted, mainly because you must deal with the very possible high silver content.

Quote:

> Thinking there might be some PL, I added some Sodium Chlorate. It boiled over into my heating element, so I unplugged it and dumped the solution back into my big solution.
>
> I added a ton of SMB (I guess the nitric) was not all gone.
>
> I sprinkled ammonium chloride into the solution moving very slowly through the filters and it turned red.

It was a mistake to add any of these chemicals before taking care of the nitric. However, it is less of a problem than you might think.

How I would have done yellow Dental Gold. I am using real nitric acid.

All of the techniques not covered in detail are covered in detail elsewhere on this forum.

INQUART

(1) Weigh the metal

(2) Inquart with silver or copper. First, though, calculate the copper or silver you need to end up with 25% gold. Make sure the molten alloy is well mixed before shotting. Stir with a carbon or quartz stirring rod (jewelry supplies).

DISSOLVE THE COPPER, SILVER, ETC. IN NITRIC

(3) Estimate the amount of nitric nedded to dissolve the Ag. One gram of copper needs about 4.2 mLs of concentrated nitric. A gram of silver will need 1.2 mLs.

(4) Put the metal into the Pyrex dissolving container. You could use plastic and no heat but, it's slower. For small amounts, I prefer glass beakers so, I can heat them.

(5) Cover the metal with distilled water, plus about 1/4".

(6) Heat the solution until you first see whisps of steam coming off. I like the hot plate about medium. Medium low for very small amounts

(7) Measure out the calculated total amount nitric you'll need.

(8) Dissolve the Ag, Cu, etc., with nitric. Add about 5 mL of straight nitric. You will immediately get action. It will shortly (few minutes) slow down. Give it a gentle but complete stir. It will flare up a little bit. Let it relax. Add some more nitric. When it's finished, add some more. Repeat until all the the Ag, etc., is dissolved and you only have gold powder. Test this by dragging the powder to the side of the beaker and looking at it. You can, also, mash around with a stir rod, to check for lumps. You may need about 10%, or so, extra nitric. Try not to use too much. This whole thing should take 15 to 30 minutes. The reason to start with only 5 mL, is to prevent it from foaming over. The solution will get quite hot from the dissolving and, you have to be careful of instant foamovers. Towards the end, you can progressively add more nitric at one time. But, never add more until the last addition has died down.

A good reason for working with heat is to eliminate foamovers. When you add a little nitric to a cold solution, it, at first, won't do much. You add a little more and, maybe, a little more. As you've been doing this, the dissolving action is heating the solution up, slowly. When it reaches a critical temp., it suddenly all works at the same time and, boils the solution over. Don't ask me how I know this. Most boilovers are caused by working with cold solutions or, by dumping all the acid in at the same time.

You will probably need more water, as you go, to keep the metal salts from crystallizing. At the end, you want to end up with 50% water. Stir.

(9) Allow to cool and settle over overnight. I like to prop a piece of wood under it, so the solids settle to one corner.

Note: Summary of what we have to this point. It's good to figure out what is where, no matter what you're working on..
----**(a)** In the solution, we have all of the silver, palladium, and all the base metals. If we used silver to inquart, instead of copper, we will also have some platinum in the solution.
----**(b)** In the solids, sitting in the solution, there is most or all of the platinum and all of the gold and, some dirt.

(10) Separate the solids from the liquid. You can filter and rinse it or you can pour off the solution with several rinses - pour off - rinse - settle - pour off - repeat. For the best chance at good final purity, filter and rinse well.

DISSOLVE THE GOLD AND PLATINUM IN AQUA REGIA

(11) Put clean solids in beaker.

[/b](12) Cover solids with the muriatic or hydrochloric.[/b] You should calculate how much HCl you need and add about 20%. For one ounce of gold, figure about 120 mL of HCl. It's very important to have extra HCl. But, it's wasteful and more cumbersome to add way too much.

(13) Heat on medium until you see whisps of steam

(14) Calculate and measure out how much nitric you'll need Figure about 20-25 mL, per ounce of gold. Measure on the low side. The goal is to never add any more nitric than is necessary to dissolve the gold and platinum powder.

(15) Add not over 5 mL of nitric Action will start immediately. When it dies down, stir it and add some more nitric.

(16) Repeat adding nitric until the gold/platinum powder has dissolved. Add - wait until reaction slows - stir - repeat. This may or may not take all the nitric. Especially towards the end, allow the action to completely stop before adding more nitric.

Note: The magic of adding a little too much HCl and just enough HNO3 is that, when you finish, there will be none, or very little, extra nitric in the solution. Thus, boiling down or, adding urea, isn't necessary. The first addition of SMB or FeSO4 will start dropping gold!!! If, you used too much nitric, use urea, that you've dissolved in water, until you get a pH of one.

IMPORTANT: Gold in powder dissolves rapidly. If you add too much nitric, the solution can foam over, quicker than you can say Jack Spratt.

The depth of the solution will make a difference in the speed of the dissolving. The deeper it is, the slower things go. The acid is way up here and the solids are way down there. For maximum speed, use a container that will keep the acid under about 3" deep.

To kill or slow down foamovers, buy a small container of Anti-Foam located on the same rack as carpet cleaner rentals in the supermarket. Add 1" of the concentrate to a spray bottle and fill it up with water. Spray a little on the climbing foam. Often, it stops the foam. Sometimes, especially when real hot, it only slows it down. Believe it or not, just water in a misty spray bottle does a pretty good job on foam. Another weird way to to put a little oil on you fingertip and wipe it around the top edge on the dissolving container. I don't like oil in the solution. It tracks over to the next processes. I only use it rarely with large amounts of acid when no values are in the solution.

(17) Heat more strongly at the end but, don't boil. Platinum dissolves a little slow and needs some heat.

(18) Check to see if everything's dissolved. Tilt the beaker, stir the solution, let it settle a bit, and, using good light, look at the settled solids, if there are any. If the container is small, pick it up and look at the bottom.

(19) If needed, add more nitric. Heat it up and add only 2 or 3 mLs at a time. Let it settle totally down and stir before adding. Keep checking for solids. Don't add too much.

FILTER AND RINSE

(20) Add 3 times water and let it cool and let the dirt settle.

(21) Filter Carefully pour the solution into the filter. Keep the solids in the beaker. When all the solution has drained through, rinse the solids (dirt) into the same filter. If things slow down, get a fresh filter.

(22) Rinse the filter well.

DROP THE GOLD

(23) Choose a precipitant. There's a long list of things you could use: Ferrous Sulfate; SO_2 gas; Sodium Sulfite; Sodium Metabisulfite; Sodium Bisulfite; Oxalic acid; Sodium Nitrite; Hydroquinone; Metol; Etc. The last 4 are only used in special situations. For this job, I should (but, probably wouldn't) first use green Ferrous Sulfate ($FeSO_4$ - Copperas). It will drop the gold, without dropping the platinum group, better than any other precipitant. I could use a sulfite first and then melt, shot, re-dissolve, and final drop with ferrous sulfate.

(24)Drop the gold To drop with one of the 3 sulfites, put a couple of spoonfuls in a one cup Pyrex measuring cup. Fill with hot water and stir until most is dissolved. Pour some of the liquid into the solution, let it react, and stir. If all of the nitric is gone, you should see brown powder forming in the solution. If there is still nitric, the sulfite will react with it before you start dropping gold. Sometimes, there is a false indication of gold dropping. The gold drops locally, where you added the sulfite but, when you stir it, the gold re-dissolves.

At some point, all the gold has dropped out. It shouldn't take much sulfite, if all the nitric was gone. Also, with no nitric, you should get no boilovers. Maybe, use about ounce for ounce, with gold or, a little more. There are some visual indications of this. Without the presence of platinum group, the foam (when stirring) will get white and the yellow color will disappear. With platinum, whose solution is also yellow, this is harder to see. Test the solution, with stannous chloride, for the presence of gold. Add a little more sulfite, stir, and test. Repeat until the gold is out.

(25) Filter, leach and rinse the gold. This has been a controversial subject between Harold and I. I would probably settle first, then, - (a) Filter the tops - (b) Filter the gold in the same filter - (c) Rinse 5 times with very hot water - (d) Remove and boil in HCl - (e) Filter and hot rinse 5 times - (f) Check for the presence of chlorides coming out of the filter, with a drop of silver nitrate made from a little silver dissolved in a little nitric/distilled water - (g) Rinse until no more chlorides - (h) Mix up enough 25% nitric, diluted with hot water, to pretty well fill up the filter. With a vacuum filter, shut it off and bleed the vacuum, first. The slower it drains through, the better. - (i) When it is drained, rinse 5 times with hot distilled water. - (j) Add 50/50 household ammonia, cut with hot water, and put it in the filter. When it has drained through, rinse 5 times with hot water. (k) Rinse 5 times with hot distilled water.

(26) Dry the gold and melt it. Look for instructions on the forum. Note: if the gold powder looks grayish, it has platinum in it.

(27) Rework dirty gold If the melt, the ingot, or the powder looks dirty, it is dirty. Pt makes dirty looking powder and ingots. Sometimes, the Pt.Gp. produces a fern-like pattern on the gold ingot. Always melt and shot the powder before re-dissolving in aqua regia. Use a different precipitant. Learn to use ferrous sulfate.

GRAND SUMMARY

---In the **filter papers**, there is likely some precious metals. If you can, keep the gold, silver, and Pt group all separate. Even if the platinum group filters have gold, keep them in the Pt. group pile. You can burn the filters or, you can add some of the best aqua regia filters to the next batch, paper and all. Don't add too many papers, unless you have a lot of solution. The hot acid pulps the paper and aids in filtering. Commercial paper pulp can be purchased for use as a lab filter-aid.
---**The spent aqua regia solution.** It contains platinum, hydrochloric acid, nitrates, chlorides, sodium, and sulfite. You could drop the platinum out as a black powder with copper buss bars (A trick. If it isn't cementing onto the copper, add a small shot of nitric and stir it in). Or, you could put it into Hoke's stockpot.
---**The nitric solution** It contains silver, palladium, some of the platinum, copper, zinc, and nitrates. How do you separate the silver from the platinum and palladium? Good question. You

could drop the silver, Pt, and Pd, all together, using copper bussbar. You could then melt and run the silver through a silver cell. The platinum doesn't dissolve and stays in the cell's filter cloth. The palladium dissolves and eventually contaminates the silver cell solution. Another way would be to try and drop out the Pt.Gp., selectively, using something like hydrazine sulfate at a certain pH. Maybe, sodium borohydride would drop the silver without dropping the Pt and Pd. Anyone have any other ideas?

Chris

You have the solution, the solids and the filter paper.

The solution contains nitric acid (maybe), hydrochloric acid, gold, platinum, palladium, copper, NH_4Cl, SMB, sodium chlorate,dissolved rust, and water.

I don't think the chemicals you added will hurt. They've all been chewed up and simplified by the acids. There is likely no SMB left. Dissolved iron won't hurt.

I would settle and then filter the solution. Then, treat it as a brand new solution.

(1) Filter and rinse.

(2) Take care of the nitric, if any. It sounds like there could still be nitric in there. I would dissolve some urea and add a little bit and stir it in. Normally, if you need more urea, you will get bubbles. After all the other stuff you've added, who knows? If you have a way of measuring pH, add til the pH goes up to 1.

(3) Drop the gold. You can use ferrous sulfate or a sulfite, such as SMB. Both Harold and I have only used ferrous sulfate a few times. However, Harold probably remembers more about it than I do. Neither of us like it much and, it is more complicated to use. The Hoke book covers it in great, great detail. Ferrous sulfate is more likely to keep Pt.Gp. out of the gold, thus producing higher purity gold. A definite advantage, in your case.

Depending on how much Pt.Gp. was in the metal, the more likely you'll have to rework it again, if you use SMB. Make sure you dissolve the SMB first, in hot water. Add a little at a time and stir between additions. When all the gold is out, stop.

(4) Filter, rinse, and leach the gold.

(5) Get the Pt and Pd out of the solution. Put some lengths of copper bussbar in the solution. In your small lot, use pieces of copper sheet. The Pt and Pd should produce a black deposit on the copper. If nothing happens, after about 30 minutes, add a splash of nitric and stir it in, to get things started. I would leave it for a couple of days. With a lot of Pt.Gp. is present, the heavy black powder can slow or stop the action. Just scrape and rinse it down and put the copper back in. When finished, scrape down the copper and collect the black powder. There will also be some black powder on the bottom of the solution. I would save this powder up and do a Pt.Gp. aqua regia later on.

The Solids. You have gold, Pt, Pd, Ag, Cu, and Zn in the metal alloy. You also have silver chloride and dirt. I would first rinse, dry, and get a weight on the metal left over. Then, calculate how much acids you'll need. See previous post.

In the following, I am assuming that what you said is true, about no silver chloride building up on the metal. If there is and things slow down, you may have to remove it once or twice and boil it in household ammonia, to dissolve the silver chloride.

(1) Cover the gold with whatever HCl you've calculated. You want a little excess. Put into a beaker that is at least 4-5" tall

(2) Heat til slightly steamy.

(3) Add some of the nitric (about 1/3) of what you've calculated and measured out. Drive it hotter. Heat is very important in aqua regia, when dissolving solid gold alloys. Don't boil. When the reaction stops, stir, add another 1/3 more nitric. Add the final 1/3 in smaller increments. You may not need it all. When a small addition produces no action, you should stop adding. If you didn't have enough HCl at the first, add a slight excess and see if it starts working again. If if does, you're not finished. If it doesn't, all of the metal should be dissolved.

(4) Dilute 3 times with water, cool and settle.

(5) Filter, etc., as in (1) though (5), above, in this post.

The Filter Paper You can save them up and burn to light gray ash, melt, shot, aqua regia. I have, before, dissolved the ash directly in aqua regia. Takes more acid and is a mess but, it works.

After the metal is dissolved and, before diluting with water, you could add the papers to the hot aqua regia. In your present situation, I would definitely do this. You may need a smidgen more nitric.

Chris

Refine It
When new, the worst gold filled (10K, 1/40 - 1%gold) runs about $100 per pound. The best I've ever seen ran 5.8%(14K, 1/10) - $580/pound. If you can get a lot of it, it might be worth thinking about refining. It might sound heretical but, I would shot it and dissolve everthing but gold nitric, even the gold is only 1% to 5.8%. The gold will be extremely fine, black/brown, hard to handle and hard to settle. You'll even have a little purple colloidal gold. It all will eventually settle, however. A little heat can help agglomerate (bring them together) the particles. Then, shut the heat off and let it settle. If you have glass fiber papers and a vacuum filter, you can filter it. After it settles, filter the top solution and then filter the gold, in the same filter. You can't use regular paper. It will go right through it.

If you don't have a vacuum filter, you can settle the gold and then siphon the solution off. Add some rinse water, stir, settle, pour off, repeat a couple of times. Transfer the black powder to a beaker and dissolve it in aqua regia and go from there.

Sell It

Here's the way I would do it
(1) Remove all non-gold filled materials, including grease or oil.
(2) Go through the material and sort it by markings. Keep unmarked stuff in a pile. You'll probably
(3) Weigh each pile and estimate the value per pound, based on the markings. You are now armed.
(4) Type in Google, "gold filled" scrap paying . There are literally 100's of refiners, taking in gold filled with toll-free numbers. Start calling them and getting quotes. Don't bullshit the buyer but, try to sell it. I would tell them that you're shopping around. See what they'll buy it for, outright, rather than refine it. See if they'll send you a quote, for exactly what you have, by fax (good luck). If they start changing things after they receive it, tell them to send it back.

If they won't buy it, outright, see what their refining charges are. Shop around

Make a decision. Do you want to sell it, have it refined, or refine it yourself. It's all economics.

If the lot is small, the buyer could care less. If it is pretty large, the buyer will want it.

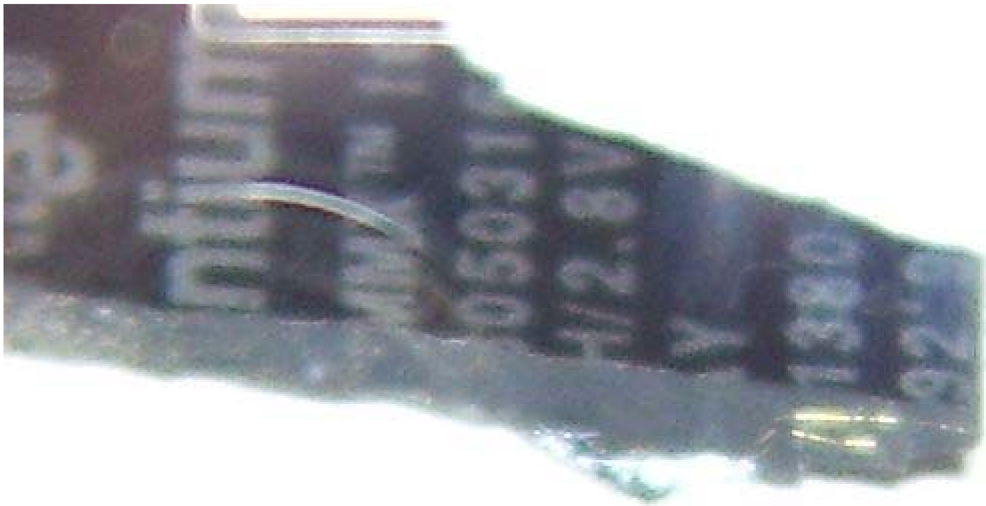
Another wild way to sell this is to call around and find buyers that will buy it, for a good price, in ingot form. This would only work for large volume. They would buy it based on assay. A buyer may be hard to find. You would need a crucible furnace and molds. It would be better to have a furnace big enough so you only have one ingot. Otherwise you pay for assays for each ingot. You melt it - Cast it - Drill it - Have the drillings assayed - Put your stamp on the ingot - Make photos of drilled, stamped ingot(s) - Send the ingot to the buyer - Have the buyer drill it and assay it. Don't let the buyer re-melt it to do this. Have him drill the original ingot. Otherwise, don't let him alter it - When the refiner finishes the assay, have him give you a quote - Take the offer or have him return it.

Chris

Astro,

Yes, the connecting wires were still gold in these cpus. I have just taken this closeup photo to prove it:

here's a second shot that is slightly out of focus, but the gold wires are clearly visible:



The early PII's were made using these wires as well. PIII's and beyond were bonded directly to the core without wire interconnects in a ball grid array arrangement.

Steve

Post subject: How much nitric acid to dissolve 1 pound of Copper?

GSP wrote:

> To quote my own post, "It takes 1/2 gallon of either nitric or aqua regia to dissolve 1 pound of copper or brass." This is the truth!!

I've worked out the **nitric acid** math to prove your point GSP 😉, the variable is the concentration of the Nitric Acid, but you are pretty much right on the empirical values as demonstrated by my calculations shown below:

Here's the balanced equation which governs the reaction:

2HNO3 + Cu = Cu(NO3)2 + H2

The molar atomic weights of the molecules involved are :

HNO3 = 63.01 g (clear to pale yellow liquid) Density = 1.4 grams per mL in 70% solution
Cu= 63.55 g (reddish brown metal)
Cu(NO3)2= 187.57 g (deep blue water soluble crystals)
H2 = 2 g (flammable hydrogen gas)

The balanced equation atomic weights are as follows:

2 * 63.01 + 63.55 --> 187.57 + 2 ; 126.02 + 63.55 --> 187.57 + 2

Factoring in the 70% percent weight of the HNO3 :

126.02 / .7 = 180.03 g 70% HNO3

Using the density of 70% HNO3 to convert grams to mL:

180.03 / 1.4 = 128.6 mL 70% HNO3 = 2 Moles HNO3

Substituting into the equation:

128.6 mL 70% HNO3 + 63.55 g Cu ---> 187.57 g Cu(NO3)2 + 2 g H2

Converting the above data to pounds:

453.6 g = 1 lb

453.6 g / 63.55 g Cu = 7.14 Moles Cu per pound

128.6 mL * 7.14 = 918.2 mL 70% HNO3 = 14.28 Moles HNO3 required

Checking results:

918.2 mL * 1.4 g/mL = 1285.48 g * .7 = 899.836 g / 63.01 g /Mole = 14.28 Moles HNO3

Converting mL 70% HNO3 to Gallons:

918.2 mL / 3785.4 mL / Gallon = .24 Gallons ~= 1 US Quart

Checking Solubility of Copper Nitrate in Water at 20 C:

125 g $Cu(NO_3)_2$ per 100 mL H_2O @ 20 C

7.14 * 187.57 = 1339.25 g $Cu(NO_3)_2$ for 7.14 Moles

1339.25 / 125 = 10.714 * 100 mL = 1071.4 mL H_2O to dissolve 7.14 Moles $Cu(NO_3)_2$ @ 20 C

Checking water available in reaction from nitric acid:

1285.48 g * .3 = 385.64 g H_2O = 385.64 mL H_2O

Required additional water:

1071.4 mL - 385.64 mL = 685.76 mL additional water

685.76 mL / 3785.4 mL / Gallon = .18 Gallons = 2.88 cups ~= 3 cups

Conclusion:

1 pound of copper metal is dissolved by 1 quart of 70% Nitric Acid diluted with 3 cups of water @20 C

The above shows that GSP's 1/2 gallon of nitric (1.75 quarts= 0.4375 US gallons calculated) is pretty much right on the mark.

I think I'll design a spreadsheet that will do the above math for each type of base metal automatically. I'll post the results of my work soon.

Excellent call GSP!!!

Steve

Gold Refining Community
Gold Refiners helping one another !

Steve,

I had a little problem following your math but it seems you came to the conclusion that it takes only a quart of 70% HNO_3 to dissolve a pound of copper. The rest of the 1/2 gallon is made up with water. I don't understand why you said that I was correct. I guess you assumed that I meant 1/2 gallon of 50/50 nitric. I didn't.

I'm saying that it takes 1/2 gallon (2 quarts) of 70% HNO_3 to dissolve 1 pound of copper. This is twice what you calculated and also twice the amount I see posted around the internet. I also add 1/2 gallon of water, making 1 gallon of 50/50 solution, to prevent crystallization of the copper. This is probably more water than needed but, it provides a good safety net.

The equation you gave is:

$Cu + 2HNO_3 = Cu(NO_3)_2 + H_2$

This is not the applicable equation. You didn't consider the NO or NO_2 gas that is produced.

The actual working equation for concentrated nitric is: (Call this equation #1)

$Cu + 4HNO_3 = Cu(NO_3)_2 + 2NO_2 + 2H_2O$

For very dilute nitric, the equation is different: (Call this equation #2)

$3Cu + 8HNO_3 = 3Cu(NO_3)_2 + 2NO + 4H_2O$

Actually, in this last equation, the NO (colorless gas) immediately combines with oxygen from the air to form NO_2 (red-brown gas). Here's the overall equation.

$3Cu + 8HNO_3 + O_2 = 3Cu(NO_3)_2 + 2NO_2 + 4H_2O$

Now for the math - first for equation #1:

One Mole of copper is 63.55 grams. Therefore, in one pound (454 grams) of copper, there are 454/63.55 = 7.14 Moles.

One liter of 70% nitric acid contains about 15.4 Moles. A gallon is 3.785 liters. One half gallon is 1.89 liters. Therefore, 1/2 gallon contains 1.89(15.4) = 29.1 Moles.

In Eq. #1, the Molar ratio of HNO_3 to Cu is 4 to 1. Therefore, for 1# of copper, 7.14 Moles, it would take 7.14(4) = 28.6 Moles of nitric acid. Note that this is very close to the 29.1 Moles contained in 1/2 gallon of 70% nitric acid.

In Eq. #2, the ratio is only 8 to 3. This computes to 19 Moles of nitric for a pound of copper. This is about 1/3 gallon of 70% nitric. However, this equation is for very dilute nitric - maybe 1%. In practice, this very dilute nitric is not used because the reaction would be terribly slow. As I read somewhere on the net, the copper nitrate produced also acts as a solvent in very dilute nitric. This is similar to the copper chloride produced in the HCl system. This is probably one reason why the ratio is only 8 to 3 in dilute nitric. Evidently, this solvent effect doesn't apply in strong nitric.

In practice, a 50/50 solution of 70% nitric/water is usually used. This mix is considered the most efficient. It prevents crystallization of copper nitrate, improves a slight bit on the nitric required, and is still strong enough to give good reaction speed. The amount of nitric required is somewhere between Eq. #1 and Eq. #2 - between 1/3 and 1/2 gallon of 70% nitric per pound of copper. The figure is probably at least .45 gallons of 70% nitric per pound of copper, when using 50/50 nitric.

This is all theoretical. When the reaction produces fizzing, there is also some nitric loss into the air.

All in all, in practice, it takes very close to 1/2 gallon of 70% nitric acid (1 gallon of 50/50 nitric) to dissolve 1 pound of copper metal. I have proven this to myself 100's of times. It never fails, although it can be plus or minus a bit. This is the first time I've actually calculated it and I'm not surprised that the math worked out with my experiences. Try it out and see for yourselves.

The ratio figures for copper alloys and nickel will come out about the same as in pure copper above, when dissolving with nitric. For silver, one gallon of 70% nitric (2 gallons of 50/50 nitric) will dissolve about 7 pounds - 100 troy ounces.

The equations for aqua regia, being a two acid system, are much more complex. There are several different ones, all probably happening, to various extents, at the same time. It is almost impossible to predict what is exactly going on. There are too many variables involved: temperature, acids ratio, metals involved, etc. However, for most base metals, including iron, the approximate ratio is the same - about 1/2 gallon of aqua regia per pound of base metals. This is based on my experiences.

Alex,

Your solution didn't boil over, it foamed over. This was due to the large amount of gases, NO and NO2, produced in the above equations. Half of the nitric used is converted to gas bubbles.

Chris

Post subject: gold filled

You may want dissolve the filled or rolled gold in a solution of HLC and Sodium Nitrate or Nitrate Soda (same thing). I don’t think you need to worry about shooting it or or hitting it with nitric. I just finished 20 grams of 10 and 14 karat regular gold jewelry yesterday and today. I refine quite a bit of karat gold. I use the following:

8 oz of Nitrate Soda mixed with 480ml of very hot water and dissolve it.
960ml of HLC (32%) mixed with the nitrate soda and H2O solution. Stir the solution and let it set for about 5 minutes. Salt will form on the bottom of the container. I just pour off the clear solution. This amount of (sic) Aqua Rega will dissolve 140 grams of metal (plated or filled Material) or 48 grams of solid karat gold.

I cut up the solid gold into small pieces and put them in the solution. Then take and place it on a hot plate and slowly bring it up to a boil and let boil until all action stops. should take about 15 to 20 minutes. Every thing should be dissolved. If for some reason some of the gold is not dissolved and is coated with silver chloride, then take that material and boil it in ammonia hydroxide and it will clean up to shiny gold again and put it in AR again until all is dissolved. I never use any Nitric acid or shot it. This has always worked for me and I can achieve excellent yield results out of my karat gold. I consistently yield 41% on 10 k and 58% on 14 karat. This is + or – 2% tolerance of Manufacturing standards.

After you totally dissolve the gold then I mix up 8 oz of urea in very hot water and neutralize the AR. You probably won’t need all the urea, but I always mix a certain amount incase all the nitric hasn’t been used up. If you get too much urea in the solution, no big problem for it is in liquid form, wont hurt anything. It’s better to have too much than not enough. Filter your solution good, I use a vacuum filter and then add 1 oz of SMB mixed with very hot water, and stir good. Let it set for a few hours if you are not in a hurry. Some folks heat it up to speed up the precipitation. When you get to be an old fart you stop being in a hurry. When you let the gold precipitation. Always test the spent solution for gold with test solution. Never, never leave the table with possible gold left.

Make sure you use a heat resistance container. I use Erlenmeyer Flasks and always a glass stirring rod.

If you would like some more info on this method, PM me and I can send you an excel sheet with all my formulas on all different amounts of plated, filled, rolled, karat gold and also CPU chips. Also how to test a pins for a educated guess on just how much you can expect from a plated item.

Catfish

AR Processing materials

Hey Mayhem:

You need to go to your local feed and fertilize store or garden center. They sell Nitrate Soda, same thing as Sodium Nitrate, 4 lbs for $6.25. This will be 16% Nitrogen. Manufacture is Hy-Yield and there are other brands too. All about the same price. This is much cheaper than sodium Nitrate and the same thing.

You can buy the Muriatic acid (Hydrochloric acid) called (concrete cleaner) from any builders supply, Lowes or Home Depot, just look in the Paint section. Be sure and ask for concrete cleaner or Muriatic acid, they will not know what Hydrochloric acid is. This will be 31 to 32% Hydrochloric acid. Costs about 4.20 per gallon

You can buy Urea from the same fertilizer stores or garden centers. Cost is $8.60 per fifty (50) lb bag. This will be about 39 to 40% nitrogen.

I buy my Sodium Metabisulfite from the chemistry store. There are many other places that sell it too. All about the same. In fact someone on the forum mentioned about having some for sale. The cost is not bad from The Chemistry Store, (10.50 for 3 lbs) but the shipping is a bitch. (12.50) UPS only

As far as different kinds of precipitants, Harold has recommended different precipitants for different chemicals. I only use the SMB. I always test the solution with precious metal detection solution to make damn sure there is no gold left. Good commercial test solution will last about 6 months and test as low as 4 parts per million. The home made solution will only last about a week and may not consistently test as low as commercial test solution. So far I have never encountered a situation where I needed another precipitant yet, but you must remember, Harold and Cris has been doing this a long time and both are considered professionals in my opinion in this field. I am just a neophyte. You may want to pm them and ask their advice or recommendations.

When you get all your stuff lined up, hit me on PM and I will walk you through the first batch, it if you want.

8 oz of Nitrate soda .50
32 oz of hydrochloric 1.05
8 oz of Urea .09
1 oz of SMB .48
Total per batch 140 grams ____
of pins or 48 grams of karat $2.12
or about $7.00 per pound of pins.
gold.

If you should get some urea that has trash in it, no problem, just let me know and I will tell you how to handle it.

Lots of luck Catfish

Hard disk contents

Hard Disks

Platinum coated computer hard drive disks.
Click on image to enlarge or order. Platinum and data storage
The need for modern computers to store very large amounts of information has brought a rapid increase in the use of platinum to improve the data storage capacity of hard disks. The first hard disk drive, introduced by IBM in 1957, used fifty disks, each measuring 24 inches in diameter, to store just 5 megabytes of data. Nowadays, PC hard disks are available which can store 125 gigabytes (125,000 megabytes) of data, and capacity is increasing all the time. Manufacturers aim to continually reduce the average number of hard disks in each drive, so technology which can offer denser data storage is eagerly sought after.

Inside a hard disk
A hard disk drive looks and operates much like an old fashioned record player. Information is recorded and retrieved by a magnetic head mounted on a moveable arm, which hovers over a rapidly spinning disk. Each drive contains one or more disks; the disks in desktop PCs are usually made of aluminum, whereas high quality glass is often used for disks in laptop computers.

The disks are coated with a cobalt based alloy which has magnetic properties. This magnetic layer stores individual pieces of data, or "bits", in a series of circular tracks. The amount of data which can be recorded on a given surface area depends largely upon the strength of the field generated by the magnetic layer. Adding platinum enhances the magnetic qualities of the cobalt alloy, enabling data to be stored at higher densities and improving access times.

All disks contain platinum
Information storage requirements continue to expand at rapid rates, fuelled by the growing use of computers for video and audio applications. Today, all hard disks contain platinum in their magnetic layers, compared with around 50 per cent in 1997. The proportion of platinum in the magnetic alloy has been increasing steadily over time, from less than 10 per cent five years ago to over 35 per cent, on average, today.

Here's some more information on Pt in hard drive platters.

http://www.platinum.matthey.com/applications/harddisk.html

http://domino.research.ibm.com/comm/pr.nsf/pages/news.20010518_whitepaper.html

http://news.com.com/A+divide+over+the+future+of+hard+drives/2100-1008_3-6108687.html

Steve

Steve,

Here's the equation for making Nitric acid

NaNO3 + H2SO4 = NaHSO4 + HNO3

Here's the weights in grams, rounded off, for the reaction to produce 1 liter of 70% nitric acid.

This assumes that everything is anhydrous which, of course, it isn't. I have included the 30% water in the nitric on both sides. More water than this will be needed to dissolve the NaNO3 so, the nitric % will be less. Also, there's water in the sulfuric to consider.

1330(NaNO3) + 1533(H2SO4) + 422(H2O) = 1878(NaHSO4) + 986(HNO3) + 422(H2O)

One liter of 70% nitric weighs about 986 + 422 = 1408 grams

The salt, NaHSO4, sodium bisulfate, is strongly acidic when dissolved. It's used for toilet cleaners (Sani-Flush is 75% NaHSO4), lowering the pH of swimming pools, a safer sulfuric substitute in school labs, and an acid pickle for silver castings.

NaHSO4 is very soluble in water, even at 0 deg C. Here's the solubilities: 500 gm/L at 0 C., 670 gm/L at 22 C., and 1000 gm/L at 100 C. If you plot those out, it curves down to the left and seems to hit zero at about -80 C. This happens to be the temp. of dry ice. It seems like, if you used dry ice, you could get all of the salt out. The problem is, nitric freezes about -42 C. and, this figure is probably for 100% nitric. For 70%, it would be higher. There is most likely a low temp to maximize salt dropout without the nitric freezing. You could use a thermometer.

On the net, with the little amount of info that I could find on the process you're doing, they required distillation to get rid of the salt. Of course, they didn't think about chilling it.

The solubilities, above, are for the salt dissolved in water. In the presence of the high nitric acid, the solubilities might be a lot less.

All in all, we don't need 70% nitric acid for most any of our processes. For dissolving silver, copper, etc., a 50/50, nitric/water, mix of commercial 70% nitric, cut by volume, is the most efficient mix for dissolving. This figures out to 41% nitric by weight. For aqua regia, I usually add about 10% water, for effeciency. I could use a weaker nitric, add no water, and end up with the same thing. The nitric for this purpose would be about 53%, by weight, assuming a 3/1, HCl/HNO3 mix.

Also, if the nitric % is high enough, the presence of some of the salt in the solution might not interfere much with our processes. This would require experiments.

I downloaded a couple of old industrial chemical books on Google Books. I found another process. Instead of sodium nitrate, they used barium nitrate. The equation, otherwise, is about the same. It takes about 1.5 times as much weight of Ba(NO3)2 as it does NaNO3. The big difference is that Ba(NO3)2 is only about 10% as soluble in water as NaNO3. Therefore, the nitric yield was only about 10%, by weight. They said you could boil it to raise it to 25%, the point at which HNO3 starts coming off. The 25% would work for our processes but, not as fast. The beauty of using Ba(NO3)2 is that the resulting salt, BaSO4, is zero soluble in everthing and, therefore, could be completely removed at room temp. About the cheapest I found barium nitrate was from pyrotechnic chemical companies, for about $3.30/pound. That was for one pound quantities. They couldn't ship it, so you had to pick it up.

Steve, unless I made mistakes, those are the numbers. I wish I had a lab but, I don't. If you need help or advice, I'm here. Please keep us posted with your progress. As you know, this process could be very important to all the members that can't get nitric acid.

Liquid precious metals and coloured enamels are extensively used in decorating glass bottles for the premium drinks and perfume markets.

slotted cpu fingers

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They come off of slot 1 cpus, typically PII or PIII as seen here without a heat sink:

Steve

CPU chip identification http://cpu-museum.de/

Much of the gold value will be under the chip, if it's attached with gold/silicon solder. I believe the solder makeup is 96Au/4Si. About the only thing that will dissolve it is true hot aqua regia. The acid can only dissolve the solder starting at the edges of the chip. It can literally take take days for the hot acid to completely undermine a large chip.

The main reason for breaking up the CPU is to break up the chip. This provides much more chip edge area for the acid to penetrate. It will still go slow. When the gold is gone, you'll be able to slide the pieces around on the pad.

We used to speed this up on all-gold side braze packages by heating the part up to the melting point of the solder, on a heating block, and removing the chip with a vacuum probe. A sharp pointed knife, like an Z-Acto will work. We then put chip and package in the aqua regia. I think the solder melts around 700-800 F.

There are several possible sources of gold on these parts. The percentages are educated guesses and only apply to all-gold parts - gold in every category below.

High value: 60%
- Gold(80%)/Tin(20%) eutectic braze used to attach the gold plated metal lid to the ring
- Gold(~96%)/Silicon(~4%) eutectic braze used to attach the chip to the pad

Medium value: 30%
- Gold plating on the legs
- Gold plating on the metal lid

Medium Low value: 10%
- Gold plating on the inside fingers
- Gold plating on the inside pad - the flat square area where the chip is is mounted
- Gold plating on the bottom of the chip
- Gold plating on the ring where the lid is attached

Very Low value: 2%
- Pure gold bonding wires going from the chip to the fingers - about a mile (1 mil dia.), or two (.7 mil dia.), of wire to the troy oz. This figures out to $.005 to $.01 per inch of wire.

Chris

H2O2 and HCL solution for disolving fingers and CPU Chip pin

This is a comment on Steve’s tutorial on Using Hydrogen Peroxide and Hydrochloric acid to dissolve fingers from circuit boards.

I just finished a small batch of fingers, header pins, and chopped up circuit board foil. I did about 450 grams of mixed pins and fingers and etc. I started the batch on Wednesday afternoon and finished up today, Sunday afternoon, four (4) days later. All the gold was stripped off all the fiber and also the headers too. After diluting the H2O2 + HLC mix, I vacuumed filtered all the remaining material. After three separate washes with HCL and water, I partially dried the gold foil.

At the same time I performed this batch of fingers in the H2O2 +HCL mix, I started a separate batch of PII fiber chips in spent aqua regia. They were finished to day also. The settled pins contained quite a bit of copper pins too. I washed the mixed pins and soaked them in the (self made Nitric Acid) using Steve’s formula posted last week. The acid quickly dissolved all the copper and left just gold pin foil. Washed it several times in HCL and water.

I weighed the foil from the H2O2 + HCL. They weighed 6.1 grams (damp weight). The PII pin foil weighed 2.0 Grams for a total of 8.1 grams. The fingers came from an IBM 360 main frame computer circuit board. Very high gold content.

I then mixed up some aqua regia (Nitrate soda And Hydrochloric and dissolved the gold. This only took a few minutes to totally dissolve the gold foil. I now have placed it in the precipitation process and will take up tomorrow. My objective is to mine about 5 grams of good gold out of this batch.

Folks, I have learned that this method is probably one of the best methods of stripping fingers and **CPU** chip pins. We all have heard the old saying “It hard to teach an old dog new tricks” Well this is twice in the past two weeks, that I have learned two valuable lessons from our very own, “Lazersteve’s Tutorials” This method of dissolving fingers and **CPU** chip pins, and also how to make an acceptable grade of nitric acid. Both methods works great.

I realize that these accomplishments are considered very basic to some of you old timers, but to me, I think they both are a fantastic achievement I am an old guy, but new to gold recovery/refining. Thanks, Steve for your ideas and sharing them with us newbie’s and neophytes.

Thanks again to Steve and the many others who have contributed to this forum. It doesn’t get much better than this.

Catfish

what is a good way to get the precipitate after dropping from solution?

I don't care what method you try, the one that will work best is to simply leave the gold powder in the beaker in which it has been precipitated and wash it after decanting the barren solution from which it came. Lots of good things come from this. One of them is that there is no risk of losing any of your gold, which should be washed before handling, anyway.

The real benefit of doing what I suggest is that gold that has precipitated from questionable solutions often comes down as very fine powder, hard to gather well, and often very slow to settle. By washing properly, the gold will begin to clump up and settle much quicker, so you not only improve the quality of the gold, you also improve it's handling characteristics.

If you follow proper washing procedures, when the gold is finished and dried, it can be handled perfectly well, without fine particles clinging to the container. If gold doesn't behave as described, it's not pure. I experienced that problem routinely when precipitating gold from bench filings. They were not melted and inquarted, simply boiled first in nitric, then dissolved in AR. Quality was always suspect, but the gold was also refined a second time to insure high quality.

I'm very narrow of mind where this subject is concerned. Handling your precipitated gold by any other means makes no sense unless you enjoy the struggle.

Harold

Harold_V

I know you use Sodium dioxide.

I can't get it, so I use SMB. Do you subscribe to the theory that subsequent AR then droppings to purify should utilize different precipitants?

Like 1st time use SMB
2nd use Oxalic acid
3rd use ???
4th go the DMG routew/ Oxalic acid again?

Other precipitants sound as though they might introduce additional metals in, which you are going to have to take out.

Paige

Paige wrote:

> Harold_V
>
> I know you use Sodium dioxide.
>
> I can't get it, so I use SMB.

Same thing. I used sulfur dioxide, not sodium dioxide. As I understand it, SMB yields sulfur dioxide, which is actually doing the precipitation.

Quote:

> Do you subscribe to the theory that subsequent AR then droppings to purify should utilize different precipitants?

While I rarely practiced that process, yes, I subscribe to it. It makes sense, and could have solved one problem I had for all the years I refined.

When I processed (jewelry) bench waste, certain customers material always included something that followed the gold. I was never able to identify what the substance was (I'm not a chemist and had exhausted my bag of tricks) so I learned to use that gold as my added gold that was used in evaporation. The melting process seemed to eliminate the majority of what ever it was, but it was obvious it was there. The gold would melt with a little activity, with tiny sparkles flying off the powder as it melted.

If I simply re-refined this gold, the substance precipitated with the gold with each refining, although not completely. I assume that if I was to refine the gold several times, it would slowly be eliminated, but I was pleased with the process I was using, which, for me, was important, for it served a purpose and solved the problem at the same time.

The substance of which I speak showed in the wash as a brown liquid. It was far more soluble in water than it was in acid----the majority of it would wash out in the rinse instead of the acid boil. It was brown in color, and nothing I tried to determine what it was yielded an answer.

I would suggest to you that if you precipitate gold a second time, but do your preliminary functions properly, you should get very high quality gold, assuming you follow my washing procedures. I can't imagine the need for more than two refinings.

The most valuable thing any of you can learn is to precipitate gold from the cleanest possible solution. If there is no garbage to drag down, none will be. Dissolving base metals with gold, then expecting the gold to come down clean makes no sense. Look at it like this. If you drop an object in a bucket of mud, can you pick it out and expect it to be clean? By sharp contrast, if you drop the same object in a bucket of clean water, it might be wet, but you won't have added anything to make it dirty.

If you follow good work practice, you should be able to approach 4 9's quality by refining your gold a second time, even using the same precipitant. Just keep things as clean as possible in all cases----

You reach a point of no return, where regardless of how many times you refine gold, it will not get any cleaner because you're contaminating it in other processes. How you wash, handle and melt your gold is as important as how you precipitate the powder. Work with clean tools---including the torch tip. Keep one that is used solely for melting pure gold, and clean it often. Do not let it oxidize to the point where it sheds bits of oxide.

Quote:

> Like 1st time use **SMB**
> 2nd use Oxalic acid
> 3rd use ???
> 4th go the DMG routew/ Oxalic acid again?

My honest opinion?

Use **SMB**, working with clean solutions as I've already recommended. I wasn't thrilled with oxalic acid, so I tried it only once. Didn't like the results. If I was to recommend anything aside from **SMB**, I'd suggest you use ferrous sulfate for the first precipitation, the **SMB** for the second. I used only SO2 for years and got very acceptable results.

Quote:

> Other precipitants sound as though they might introduce additional metals in, which you are going to have to take out.

I agree. There are many substances that will precipitate gold, but they may or may not be selective. The field of choices is narrowed because we try to recover only the gold.

I wouldn't hesitate to use ferrous sulfate. I used it with good results, and found it washed out easily by my cleaning procedures. I moved away from its use only because it added so much volume to my processes. When you refine from beakers instead of plastic buckets, and you have a hot plate covered in beakers, with more waiting for a spot on the hot plate, you learn to conserve space so you can keep up with the work. Using SO2 from a bottle added nothing to my solutions, and allowed me to operate with greater levels of concentration. My solutions were so highly concentrated when I started the precipitation process that I had to use ice, otherwise the soluton overheated and the gold ceased to precipitate. It wasn't uncommon to precipitate 18 ounces of gold from a 4 liter beaker. The vessel, with roughly one liter of solution within, was filled with ice before introducing the gas. When the gold was down, the solution was warm. In this process, it is important that an ammonium hydroxide wash be included, to eliminate traces of silver chloride.

Once again, I'm posting a picture of gold that I refined. This gold was refined two times, both times precipitated with SO2. It was washed by the method I propose, and needed no pickle after melting except to insure that there were no traces flux that followed the gold when it was poured to make shot. It has to be very close to that magic 4 9's we all seek to achieve.

Harold

JAN 15 2004

Pentium 200 MMX

Yes, the connecting wires were still gold in these cpus. I have just taken this closeup photo to prove it:

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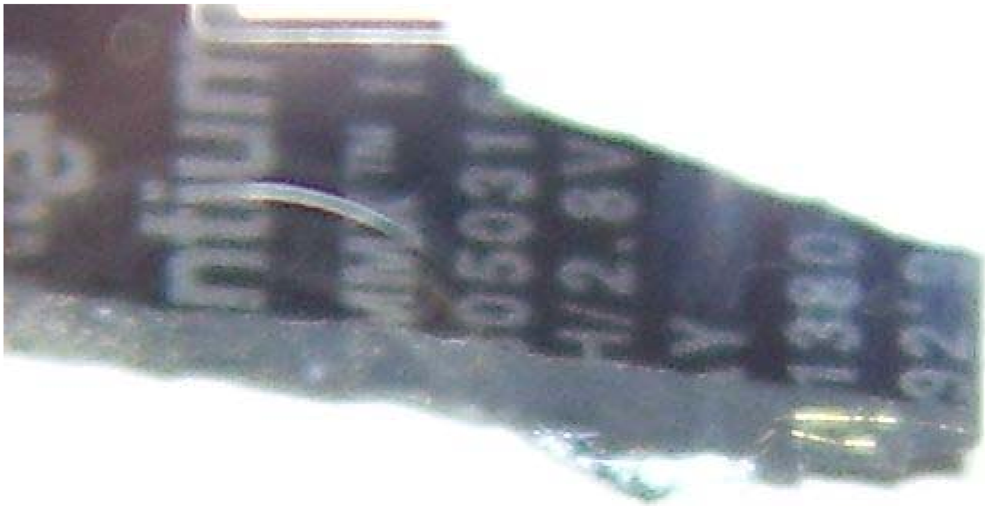
here's a second shot that is slightly out of focus, but the gold wires are clearly visible:



The early PII's were made using these wires as well. PIII's and beyond were bonded directly to the core without wire interconnects in a ball grid array arrangement

Steve

Ralph,

The video on my site will work for fiber type cpus and for removing the BOTTOMS of ceramic cpus, not the tops. The tops are bonded and/or alloy soldered to the ceramic housing. The heat gun won't get hot enough to melt the alloy to any great degree. Even if you got it hot enough the heat spreaders are often bonded with on hell of an adhesive to the ceramic also. The top plating from these 'gold top' cpus are best stripped with the cell. AP will attack the plating, but won't get thru the alloy solder around the edges. I think GSP mentioned something about this alloy solder in the distant past. I should hunt up a datasheet on these to get some real facts for everyone.

Steve

Old but new I200 Pentiums

Two drops of muriatic acid and 1 drop of hydrogen peroxide will settle it. Apply the reagents to a clean cpu top and wait 5 minutes. Slightly buff the surface with the cotton swab. Nickel will dissolve as a blue green liquid where Platinum won't.

Here's the results that I got this morning from this test:

Thumbnail, click to enlarge.

Clean the area. Drop of 50/50 nitric - let it work; several drops (2, or 3 - you must neutralize the acid) of ammonia; drop of dimethyl gloxime (1% in alcohol or dist. water - it dissolves very, very slowly in water). Nickel will turn bright red. I hope I remember that right - I didn't look it up. If the nitric goes slow (cold outside), first heat the area a little bit with a lighter. It the part is thin, heat from underneath. Or, put it in a warm place and let it warm up first.

Chris

DMG will turn bright yellow (precipitate) in the presence of palladium, on the acid side. On the ammonia(cal) side, nickel turns bright red. A gram of DMG is about a lifetime supply. One gram makes a 100 mL. of solution. One mL is about 20-25 eyedropper drops. It only takes one drop. That's 2000-2500 tests per gram.

Fisher Scientific, on the net, has 100 grams for $116. You could probably find it cheaper. You could spread the costs among, say, 15, or more, people and have someone get it, divide it up, and mail it out. Or, someone could buy it and sell it by the gram for a few bucks. Let him make a few bucks for the effort. It is harmless to ship, I think. Just use a small ziplock baggie inside of a pill bottle. If you make the mistake of using this for refining Pd (it expands about 100 fold, at least), Chris

I think I remember that 1% DMG will dissolve, in distilled water, in about 2 days. Make in up in a dropper bottle and shake it occasionally.

DMG dissolves immediately in alcohol. I usually used grain alcohol (ethyl) - Everclear in a liquor store. Or, I might use denatured alcohol (pharmacy), which I think is ethyl with a little bit of methyl, just to make you blind if you drink it. I don't use rubbing alcohol, which is 30% water and 70% isopropyl alcohol. When it said alcohol, I used alcohol.

DMG in water or alcohol seem to do the same thing. Make both up at 1% - 1 gram per 100 mL of solution. Chris

I was able to purchase some DMG solution locally. It was about $10 for 1 oz. I was in an alcohol solution and the kid that sold it to me thought it was 5%.

Tomorrow I am going there again, and will see if he has a ready supply of it. He was out of the chrystal form and didn't know when or if he was going to get more.

But if Steve bought a bunch, he'll probably make it available.

In the picture is the test The green solution is nitric acid with unknown metals in it. I poured some into the small beaker and added household ammonia to it. It forms a white, cloudy precipitate. Like silver chloride. Upon adding more ammonia it turns the pretty blue, which indicates copper.

Then I took a drop of the blue solution on the piece of tile, and added a drop of DMG. It turns red instantly. If you don't use enough ammonia to neutralize the acid, the DMG won't work.

On nickel metal, I scuff it with sandpaper add a drop of ammonia, then a drop of DMG and the metal shows a faint red color. But the ammonia has to be used again, or it won't work. Don't know why. **PhillipJ**

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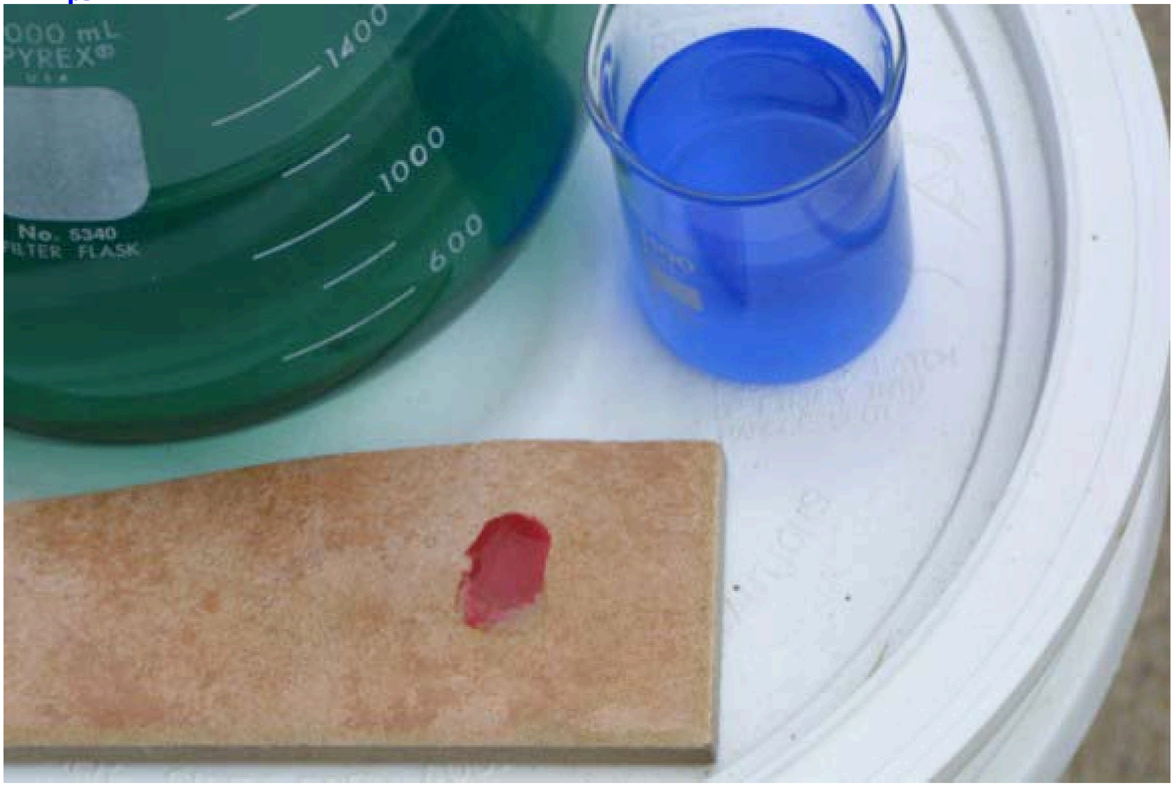
PhillipJ



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Just a quick question here? Is the metal plating on automobile headlight reflectors ruthenium or rhodium. I get them confused.

It is rhodium, and only certain ones. I don't know which ones, but I would guess high end. If they all where I think the junkyards would be saving all of them if they were coated with $6000 per ounce metal, no matter how thinly. I would be curious as to what models have the coating just to experiment with them.

Jim

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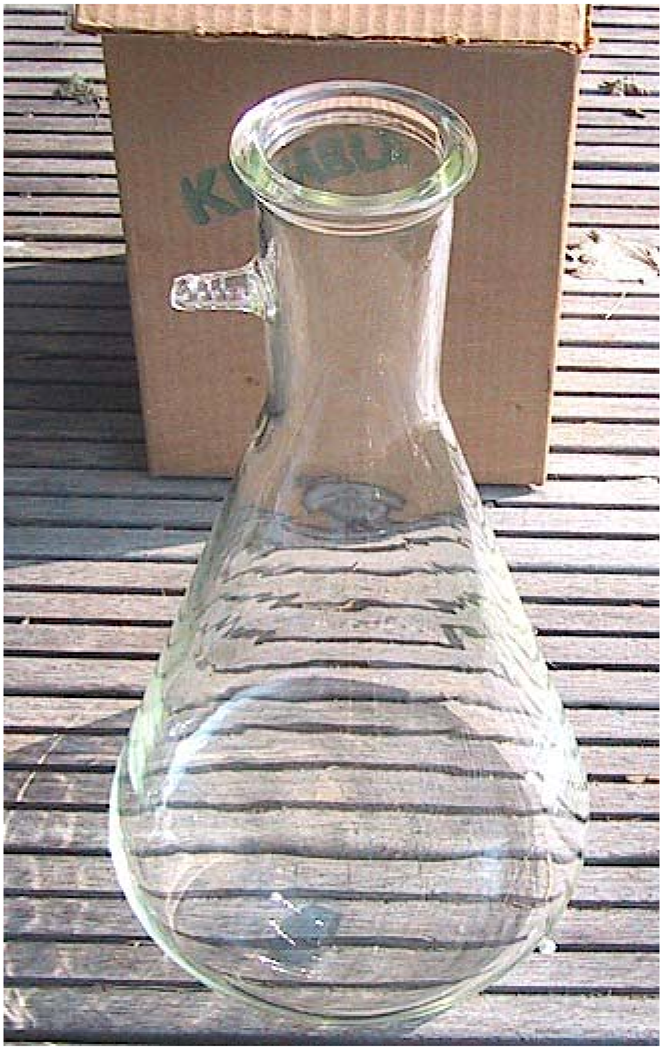
4000ml Kimax filtration flask



What to do with dental amalgam

The age old question, "What do you do with dental amalgam?" Not as bad as, "What do you do with silver plated copper wire?" Amalgam is composed of silver, tin, and mercury. The mercury is a little over half of the total weight. You first have to either retort off the mercury or, pay someone else to do it. Someone, somewhere. Maybe more local than you think. After the mercury is gone, the silver/tin alloy runs about 69/31, if I remember right. This alloy is not easy to refine. You can't use nitric acid because the nitric acid dissolves the tin and converts it to metastannic acid, a slimy mess that can nearly stop the action and shut you down.

The only good way I've seen the silver/tin alloy separated is in a silver cell. And, that's tricky.

--You could sell it as is. Dental refiners will buy it. The silver runs 33% - $62 per pound -as is. Shop around and find the best price.

--You could have it refined. The minimum lot charge may be around $250. Your 35 pounds of amalgam is worth, intrinsically, about $2170, in silver, less charges. Only God and the refiner knows how much money you'll end up with.

--You could find a buyer that would buy the Ag/Sn alloy, for probably more money, after the mercury is removed. You better make damned sure all the mercury is gone, however. You don't want the buyer to melt it and get mercury poisoning.

-- You could get a silver cell and separate the silver from the tin, after the mercury is gone. Then, sell the pure silver.
Chris

Heh!

That's true, but there is a simple way to circumvent the problem, one I used successfully for years.

After a full retort of the amalgam, my next process was to heat the remains in an open pan, almost to redness. The remains would actually melt, and were stirred until they broke down by oxidization of the tin. I need not mention that this MUST be done in a fume hood, for there are traces of mercury that still remain.

The oxidized tin didn't create the slime which is so troublesome---often coming from processing gold filled objects as well. This process made the extraction of silver dead easy. Silver was digested with nitric and tap water (I didn't care about the traces of silver chloride----which were recovered in a later operation). Once digested, the fluid was diluted by about three volumes, allowed to settle, then decanted for recovery of silver on scrap copper. I never had any problems with filtration by this method, but I can attest to the problems that are inherent if the roasting operation wasn't accomplished.

Harold

When I sold my refining business, I had in possession over 100 pounds of mercury, which went with the business. By then, the market was a tough one----buyers of mercury would pay for no less than 150 pounds, delivered. I was told they would accept the amount I had, gratis, assuming I was willing to ship it to them in approved vessels (iron flasks) at my expense. I was taken aback by their "generosity". Dentists were paying well over $15/lb for triple distilled mercury at that time, a process I had experienced myself.

I really blew it on the mercury. Had I been together, I'd have retorted and washed it a second time, then sold it to prospectors. It was selling, easily, for around $12/lb at the time, but I had my hands full and couldn't do anything with it. Can't win 'em all! 😃

Anyway, the source of this mercury was all dental amalgam. I ran a large amount of dental amalgam as I described. It really made a difference. I was fortunate to hit on the process by accident---it wasn't because I was clever. Regardless, it sure made a huge difference in the process, which I had dreaded previously.

By the way, for those that have never retorted dental amalgam, if it has come from a trap in the dental office, you can't begin to imagine the stink. I used to do all my retorting under a large hood that was powered by a 1 horse blower----the one I used to remove gasses when I'd operate my tilting furnace. Even with the hood, the smell was often disgusting. I'm not sure I'd process the stuff today if I was still refining.

Harold

Dental scrap.

Hello...

I am looking for some guidance with regards to recovery of gold , platinum , palladium and silver from dental scrap. I have done extensive work with electronic scrap (gold only) , however , this is new ground for me. I want to be as careful as possible.

I have digested 100 grams of dental scrap in AR and the solution is currently a deep dark red. There is a whitish powder that has settled at the bottom. Stannous chloride is showing a very dark red , then black.

I would appreciate any help so as to correctly move forward on this.

Thank you.

First neutralize any excess nitric acid. Then test the liquid with DMG for Palladium. You can also test a small sample for Platinum with a dash of ammonium chloride. If addition of ammonium chloride forms an orange powder you have Platinum.

Harold can give you specific instructions on this type of scrap.

Steve

Steve ,
I am planning on using butyl diglyme....so i wouldn't be needing to neutralize the excess nitric.
After I pull up the gold chloride , I plan to hunt for the platinum etc. I have SMB , Ammonium chloride and...well that's all.
I am used to seeing green solutions , this red thingy is scaring me.
Also...the teeth are kinda scary. 😈

😀

Also...I didn't heat the Ar , would this mean that the platinum is still undissolved or is it in solution?. I understand only boiling AR dissolves platinum.
Airsto

Be sure you dilute and filter your mother liquor before using the BDG. The red color sounds a lot like the Palladium solution in my latest video, it's a deep red color. Platinum can co-dissolve with silver in nitric only reactions.

Steve

> **Aristo wrote:**
>
> I am used to seeing green solutions , this red thingie is scaring me.

Don't be scared----by happy. The green solutions are an indicator of everything you don't want, and nothing you do, with rare exception.

The red solution you speak of is red because of its contents. You'll come to understand that even gold chloride assumes a deep red color when it's heavily concentrated (evaporated well).

In this case, it's likely you're seeing a combination of gold (predominant metal), platinum and palladium. As Steve alluded, palladium can yield a very red solution all by itself, although it is generally a darker color, leaning towards brown. I've seen it as bright as mercurochrome, however.

Quote:

> Also...the teeth are kinda scary. 😈

I never allowed such things to get anywhere near the process. They break out easily with a hammer on a hard surface, which should be a part of the starting process. The less you include in your solutions, the less you'll lose to dragout.

While you haven't alluded to doing so, let me give you a bit of advice here. Do not run any dental amalgam with any of the other dental alloys. The tin in the amalgam will complicate all of your filtering from the moment you dissolve them. If you get involved with amalgam, keep it separate at all times.

If you dissolved your dental gold directly in AR, you dodged a bullet. Depending on the percentage of silver contained, it can become impossible to dissolve, complicating the entire operation. Paige, one of our readers, recently experienced that very thing. I'm sure he could enlighten you as to the value of inquartation. I strongly recommend that you, in the future, inquart such materials.

As Steve suggested, when you do, some of the platinum, and a good majority of the palladium, will follow the silver when it's dissolved, so you must be able to part silver in order to recover them. That is a minor issue if you intend to get serious about refining precious metals. It goes with the territory.

I have no advice to offer if you're using anything but the system suggested in Hoke's book. That is where my experience lies------I'm an "old school" refiner. I evaporated solutions, and selectively precipitated my values from filtered solutions. I have no experience with butyl diglyme, and I have serious doubts that I'd be interested in trying it. I see no need to add steps to an already functioning system of extraction, especially when it involves more equipment and supplies.

Quote:

> Also...I didnt heat the Ar , would this mean that the platinum is still undissolved or is it in solution?. I understand only boiling AR dissolves platinum.

While it's true that platinum is difficult to dissolve, that changes when it's finely divided. It's unlikely the platinum did not dissolve----but if you see signs of black particles in with the white precipitate (likely silver chloride) you mentioned, that is probably undissolved platinum. I always dissolved metals with heat, so I'm not familiar with how they behave cold.

If you'd like to test your solution for platinum, if you'll follow these steps, you'll be able to do so.

Using a spot plate-----(not a piece of paper) place a drop of solution in a cavity. Add to this drop a crystal of green copperas (ferrous sulfate). You should see a very thin sheet of gold form, and the color of the drop change, lighter in color. Using a glass rod, stir the drop until the entire crystal has dissolved. If all the gold has not precipitated, add another crystal. Once the gold is down, split the drop in two, then test one with DMG, which will precipitate the palladium, leaving only platinum in solution. Allow the yellow precipitate to settle, then drag as much of the solution to another cavity as you can, leaving behind the yellow material. You can now test with stannous chloride-----and expect a coffee colored reaction if you have platinum present. If the concentration is quite low, the color may even lean orange. The darker the reaction, the deeper the concentration. You can use the second part of the sample to repeat the test if needed. If not, wash the entire thing into your stock pot, for eventual recovery.

Harold

Aristo wrote:

> I added ammonium chloride to the dilute AR , but no ppt.

The solution should be concentrated before attempting precipitation of Platinum or Palladium. Work with a small volume first to get the feel of the reaction before attempting precipitation of the whole batch.

Steve

Aristo,

Since you already used the BDG this should have removed the gold if you performed the extractions to completion (last clean BDG wash is clear after scrubbing). If this is the case, you should concentrate the solution and then add ammonium chloride to the saturated solution. If nothing precipitates (orange powder = Platinum Ammonium Chloride) then heat the soluiton and begin adding single crystals of sodium chlorate to precipitate the Palladium Ammonium Chloride (red powder). Of course the procedure is different for UREA and SMB users.

Steve

Pricing Refining Services

First off, do you really know how to refine? Can you produce gold of acceptable quality? If not, accepting his material can prove to be a fatal mistake. One of my best advertisers was a friend that was slip shod in his refining techniques, and refused to change. As he supplied low quality gold to his customers, who he had pursed with vigor, they slowly quit using his services, at which time he'd give them my name. I ended up with his entire customer base because he was inept. Please keep that in mind. You must be able to walk before you can run.

OK--my sermon is over----I hope it served a purpose.

I charged 10% for refining bench sweeps and solids unless the yield exceeded 10 troy ounces, at which time I made an adjustment, and did the work for 8%. It is a fair fee, but there were no other hidden charges, and I DID NOT steal customer values. That's the other big mistake refiners like to make.

My fee was in the way of withholding the metal. I did not accept cash payment. That insures you get paid.

I refined polishing wastes and floor sweeps for a 15% fee. You earn the money on this stuff, it's labor intensive.

Carpet fee was 50%----and it can be a losing proposition at that price. All depends on the carpet.

Harold

P_CARROLL

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[22lbs cpu lids = 22 0z gold. 1 oz per lb]

Buying and selling diamonds

I have received several requests for information on buying, and selling diamonds and gemstones. I thought I would post the following information so any one that is interested in this type of activity will at least have some of the basic information.

First of all let me advise you that I have been buying and selling diamonds for the past couple of years or so. I am still a neophyte. I learned the basics from my son, who has been in the business for several years and has been quite successful in this business.

Buying and reselling diamonds is a very serious business and requires a very comprehensive knowledge of diamonds and also the market for reselling same. There is a 900% markup in the price of diamonds from the jeweler to the buyer of used diamonds.

I do not fool with any type of gemstones at all. There are too many variables involved in determining the type of gemstone, quality and most important of all the value. The diamond and gemstone business reminds me of the age old adage “beauty is only in the eye of the beholder”.

I will attempt to post a few very important things one must be aware of in the diamond business. The first rule of business is “Supply and Demand”. There are a lot of diamonds on the open market and there is a market for them. The key is being able to determine a fair purchase value and be able to sell the diamond at a profit. Just like the used car business.

How to determine the quality of a diamond:

1. Test the diamond with a good diamond tester.
2. Make sure the diamond is not a synthetic such as Cubic Zirconium or Moissanite. A state of the art diamond tester will perform these tests with good results.
3. Once you have determined that the stone is a real diamond, then measure the stone diameter or width and length, depending upon the cut. You will need a diamond measuring device or a good pair of calipers that measure in metric.
4. Once you have determined the type of diamond, style of the cut and then you need to analyze the clarity, cut, and color.
5. Remember that diamonds are evaluated by the four (4) C’s, Cut, Clarity, Color, and Carat. Each of these components has many different scales, such as color have approximately 26 different values and etc.
6. Like I said earlier, there are many many different components to evaluating a diamond. The most common categories are as follows:

The Basics of buying Diamonds

Size in Brilliant Brilliant European European Mine Cut
Points Flawless with Flaw Flawless with Flaw
(Carat) Minor Minor

6.25 $1.00 .50 .50 .25 N/A
12.5 $2.00 1.00 .75 .50 .25
18.75 $2.25 1.25 1.25 .75 .50
25 $2.50 1.50 1.50 1.00 .75
50 $5.00 2.75 2.75 2.00 1.25
100 $8.00 4.50 4.50 4.00 2.50

This list denotes the points in carat and price per point. 100 points equals 1.0 carat and it will weight 200 milligrams or .200 grams. And if the diamond is of good quality, I would offer about $450.00 for it. Most diamonds you will run into will be small, from 1/8th to 1/2nd carat. Do not buy chips. They are worthless.

Note; a good way to tell a synthetic from a diamond is weight it. CZ and Moissanite weighs about 75% more than a diamond.

If you are serious about this business, I strongly suggest that you purchase the following books and study the ins and outs about evaluating diamonds and gemstones.

“Diamonds Buying Guide”, by Antoinette Matlins, P.G.

“Colored Gemstones Buying Guide”, by Antoinette Matlins, P.G.

Now, for a couple of personal pointers. You will seldom run into a flawless diamond in the open market. I always purchase at the Brilliant with minor flaw or less. Depends on the evaluation of the diamond. I do not bargain or hassle over the buy price. I make an offer on the above scale and if they accept fine and if not fine, go to the next one. You don’t want to get all the diamond business, just the ones you can make money on.

A buyer of diamonds that I have used and had good luck with so far. I sell most of my diamonds (the ones that my wife doesn’t get first) to private buyers at a hundred percent markup..

The folks that will buy your diamonds and also the gold or silver they are set in.

http://www.bluestone-trading.com/diamondtrade.asp

By the way they will give you 97% spot for your gold, no hidden fees.

Another site you may want to copy all their precious gems specifications, are as follows:

http://www.burma-ruby-sapphire.com/index.htm

You may want to develop your own price list, but I will share this one for you to start with.

If you have any additional questions or concerns, PM me back and I will try to address them.

Catfish

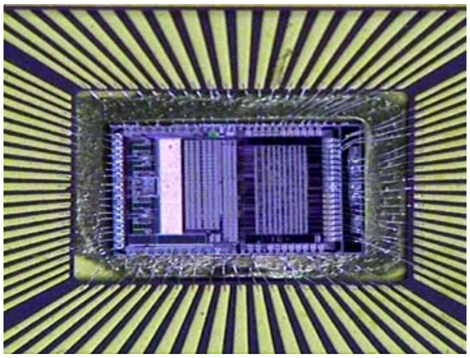
PS> The message board on the forum doesnt like any type of formating. If you want the suggested buy price list just PM me with your email address and I will send it to you.

Misc pic

Gold Based Connectors

- Palladium more expensive than gold
- Recovered Palladium refining costs higher than gold recovery costs
- Gold likely to be more competitive for such applications

Gold Refining Community
Gold Refiners helping one another !



Gold Based Solder

- Gold based solder as an alternative to lead based solder for high melting point applications

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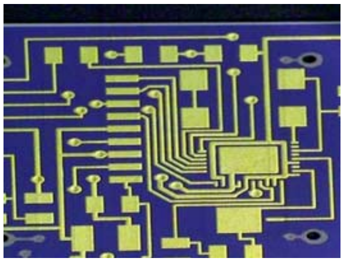
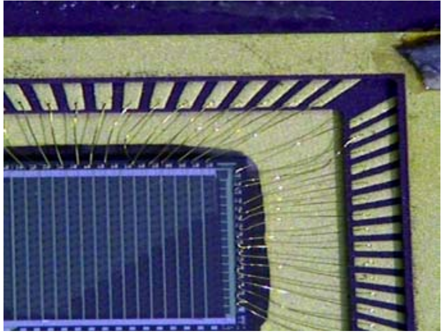
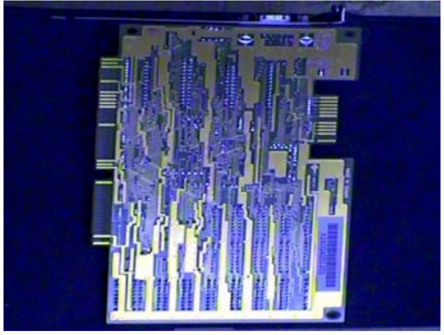
- Higher initial material cost of gold offset by recycled value and no disposal cost



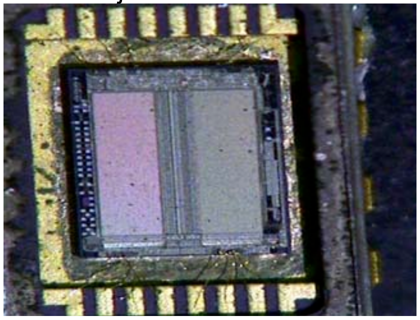
Gold bonding wires



Solderable surface coatings for PCBs and leads

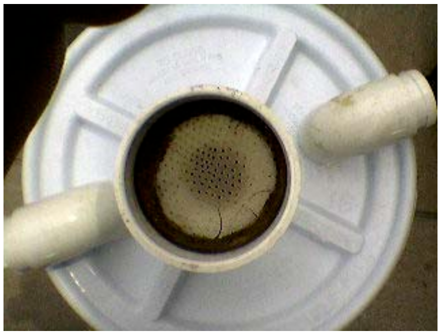


Soldered joints



Homemade 5gal filter flask and buchner funnel

Ok folks since this forum has given me so much information and help I have decided to show you my filtering set up. As some of you know I had to process alot of avionics pins which involved alot of fluids. Glassware to process a lare amount of fluids is cost prohibitive for the one man operation so I came up with the device pictured below.It is made from pvc fittings and plexiglass and can be made by the average person.I use a shp vac for the vacume source and standard size coffee filters. The buchner funnel is made from a 4-2" pvc reducer with a plexiglass plate drilled with 1/8 holes in it then epoxied in place. The air relief is a 1 1/2 pvc elbow with a bushing to reduce it to 1/2 inch for relief for the vacume cleaner so it does not suck a hole through the filter.Use the pictures as a guide. I got the bucket for free from the local pool supply store and it has a twist on lid as opposed to a regular 5 gal bucket which has a snap on lid. You must also to be sure to install a deflector on the funnel line to direct the fluid away from the vacume cleaner inlet adn point it to ward the relief inlet. Use a standar pvc elbow for this.
P_CARROLL



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FOR IMMEDIATE RELEASE

Attention All Gold Recyclers and Refiners – Help is Finally Here!

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