SAFINA, a.s., Vídeňská 104, 252 42 Vestec, Czech Republic
tel.: +420 241 024 111, fax: +420 241 024 292
e-mail: info@safina.cz, www.safina.cz
Id.: 45147868, VAT Id.No./EORI: CZ45147868, SAFINA, a.s. is registered in
the Commercial Register kept with the Municipal Court in Prague, section B, insert 1482
Československá obchodní banka, a.s., Account number: 117304913/0300, IBAN CZ4803000000000117304913

CE 0088

SP.42100.562.001

SAFIBOND

PROCESSING INSTRUCTION

SAFIBOND is a palladium-based alloy of an extra high strength for metal-ceramic dental restorations, type 4. It is very stable under process of ceramic firing. Safibond is suitable for crowns, short and long span bridges and other highly stressed works. It is supplied in the form of wafers.

BASIC DATA

Producer:	SAFINA, a.s. , Vídeňská 104, Vestec, Postal Code 252 42 Czech Republic.							
Chemical composition in mass %:	Au	Ag	Pd	Sn	In	Ga	Ru	Zn
	x	27.4	60.0	7.0	4.0	1.0	x	x
	Note: x = the content of the element is less than 1 mass %							
This alloy does not contain	Ni, Be, Cd							
Dental alloy type	Type 4 - a ceramic bonding alloy according to the ISO 22674 and ISO 9693							
Indication	metal ceramic restorations, crowns, short and long span bridges							
Storage	clean and dry surroundings without corrosive vapour at room temperature							
Shelf life	when stored properly unlimited							

PHYSICAL AND INFORMATIVE MECHANICAL PROPERTIES

Colour:	white		
Density:	10.9 g/cm^3		
Linear coefficient of thermal expansion:			
α (25 - 500 °C):	14.5 . 10^{-6} K^{-1}		
α (25 - 600 °C):	14.9 . 10^{-6} K^{-1}		
Melting interval: Temperature of solidus	1130°C		
Temperature of liquidus	1300°C		
Thermal contraction (1130 – 25°C)	1.7 %		
Yield point, Rp0.2	according to ISO22674 [1]	490 MPa	
	hardened state [2]	570 MPa	
Tensile strength R_m:	according to ISO22674 [1]	635 MPa	
	hardened state [2]	780 MPa	
Elongation, A:	according to ISO22674 [1]	12 %	
	hardened state [2]	4 %	
Hardness HV5:	according to ISO22674 [1]	195	
	hardened state [2]	265	
Young´s modulus	140 000 MPa		

REMARK: [1] After simulated oxidation and four ceramic firing at 960 °C .
[2] After a heat treatment at 600 °C/30 minutes after the simulated conditions according to the previous remark.

PROCESSING PARAMETERS

Melting	induction heating (high frequency), resistance heating, flame	
Crucible	ceramic	
Charge	new alloy or new alloy with max. 1/3 of a previously melted alloy	
Investment material	phosphate bonded type	
Preheating temperature	800 - 850°C	
Casting temperature	1380 - 1450°C	
Annealing for softening	900°C / 15 minutes - free air cooling	
Hardening treatment	600°C / 30 minutes - free air cooling	
Recommended ceramic material for veneer	Vita VM13 , Carat or other types for alloys of a high Ag contents	
Base data for ceramic firing :		
Cooling process after firing	slow	
Surface finishing	sand blasting using 50 to 125 μm pure aluminium oxide (2 bars)	
Oxide treatment	960°C for 3 minutes without vacuum, (900°C / 10 min. in case Vita**VM13** is used)	
Solders: Before ceramic firing	Safibond P – working temperature	1080°C
After ceramic firing	Safibond M - working temperature	800°C

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PROCESSING INSTRUCTIONS

1. Modelling:
Standard procedures should be used for modelling. It is convenient to use wax blanks for which the manufacturer indicates their verified shape and thickness of walls. In case of metal-ceramic works, the wall thickness of the model must not be less than 0.4 mm to ensure that the minimum metal thickness after finishing should not be less than 0.3 mm, and the area of such minimum thickness should not exceed 20 mm^2. The shape of the wax model should be anatomically dimensioned smaller due to planned veneering. Any extensive work should be correspondingly stable modelled. Sharp edges, undercuts and deep grooves should be avoided. Ensure that surfaces to be soldered are sufficiently large.

2. Sprue system:
For single crowns or bridges up to 3 units it is possible to use annular or direct sprues with minimum diameter of 3 mm. The bar casting technique is recommended for bridge works. The bar is formed with wax wire 5 mm thick. The diameter of feeder sprues should be minimally 3.5-4 mm, the connecting sprues are min. 3 mm in diameter and length of 3 mm and, possibly, cooling (outlet) sprues of 1 mm in diameter. If such principles are not followed, some contraction cavities may develop.

3. Investing:
We only recommend using phosphate-bonded investment (without gypsum bonded materials) that are intended for high temperature melted alloys, with possibility to preheat moulds to high temperature (850°C) following the instructions of the manufacturer. For example, it is possible to use the Silikan Universal investment material, mixed by Silisan N with water in ratio 1:1. The metallic casting ring should be lined with ceramic paper.

4. Preheating of the mould:
Follow the instructions of the manufacturer of the investment material (the respective times, heating rates and preheating schedule etc.). The final mould temperature should reach 800°C to 850°C and should be maintained for 40 to 70 minutes, depending on the mould size (according to the casting ring size). If those principles are observed, the mould will exactly compensate for the temperature contraction of the alloy, see article called “Physical and informative mechanical properties”.

5. Preparation of the metal (charge):
In order to achieve accurate results, we only recommend a new alloy which is not re-cast. If an re-cast identical alloy (which should be clean, not overheat, and sandblasted) is used again, minimum 2/3 of new alloy should be added to charge. To accurately assess the weight of the metal, the wax model including the sprue system (with exception of the casting cone) should be weighed. Assuming that the wax density is 1.0 g/cm^3, the weight of the metal may be calculated multiplying the wax model weight by the alloy density and adding a 0.1 to 0.9 g excess. The weight of the metal may also be determined using the following conversion table:

$M_{wax.m.}$ [g]	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0
M_{metal} [g]	3	5	7	9	11	14	16	18	20	22	24	27	29	31	33

Note: $M_{wax.m.}$ – the weight of the wax model in grams | M_{metal} – the Safibond alloy weight in grams

6. Melting and casting:
For melting, only a ceramic crucible should be used. Use only clean crucibles, one crucible per alloy. Casting shall be performed after the metal is completely melted and after the casting temperature of about 1380°C to 1450°C is reached (overheating should be avoided). If it is not possible to accurately measure the temperature of the melt, we recommend keep up heating of completely melted alloy
(according to the metal quantity) as timed as follows:
- at electrical resistance heating : 60 s – 120 s
- at el. induction (HF) heating: 5 s - 10 s
- at heating with the propane-oxygen flame: 5 s - 10 s:

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If the recommend casting temperature 1450°C is exceed or alloy is in melting state for too long period a quality of casting can be affected adversely.
Safety warning: **We recommend exhausting air that is contaminated by waste gases when mould is being heated and the alloy is being melted. The waste gases are harmful for an operating person that breathes them!**

7. Finishing:
We recommend cutting the sprues from the casting using a circular saw since the casting may be deformed if nippers are used. The casting may be finished up by grinding machine (with micro-motor) using usual procedures with hard-metallic milling cutters, diamond sharpeners or corundum discs bound to ceramics. The subsequent sandblasting should be carried out using 50 - 125 μm pure aluminium oxide (with pressure max. 2 bars).
Safety warning: **We recommend using an extraction to avoid the operating person breathes a metal dust when the casting is being finished and blasted. The metal dust is harmful for your health!**

8. Cleaning:
Prior to oxidation, the construction should be thoroughly cleaned using one of the following procedures: hot-steam cleaning (the most suitable method), boiling in distilled water for 10 minutes or ultrasonic cleaning in the distilled water for 5 minutes.

9. Oxidation:
You should ensure and maintain a sufficient support of the structure when making the operation. Perform oxidation for 3 minutes at 960°C without vacuum; (from 600°C the temperature to be increased at speed of 70°C/min. ; once you achieve the level of 960°C keep the temperature for 3 minutes, then withdraw the pattern from the oven and let it slow-cool down through the natural aeration). Should any stains occur after oxidation, the surface should again be ground pursuant to section 7. and the subsequent procedure should be followed.

10. Coating of a ceramics:
All commercially available ceramic materials with thermal expansion coefficient being 10^{-6} K^{-1} below the thermal expansion coefficient of the alloy may be used for coating, e.g. VITA**VM13** or Carat ceramic materials and other. The instructions of the ceramic material manufacturer should always be followed. The basic ceramic material should always be applied in two firing operations. We recommend starting with application of very thin, highly diluted the „washbrand“ layer. Then an opaque layer and ceramic processing in accordance with the instructions of the respective manufacturer should follow. When selecting the firing mode, we recommend slow cooling.

11. Soldering:
Prior to the ceramics application, the Safibond P solder is used: - working temperature 1080°C.
After the ceramics application, the Safibond M solder is used: - working temperature 800°C.
Soldering flux: based on borax, e.g. borax paste.
Thoroughly ungreased, possibly pickled and roughened surfaces to be soldered shall be superposed at 0.05 – 0.2 mm distance and the recommended soldering flux shall be applied on them. The parts to be soldered shall be heated to working temperature and the solder, which melts and then fills in the gap, shall be applied. The soldering flux residues shall usually be removed by pickling or mechanically.
Safety warning: **We recommend exhausting air that is contaminated by waste gases when the soldering is being applied. The waste gases are harmful for an operating person that breathes them!**

12. Hardening:
When the alloy strength is desired to be increased an additional heat treatment can be applied. But only in the case the veneered restoration is possible to heat treat at 600°C. Insert the restoration into the furnace that is preheated to 600°C. After 30 minutes of the heat treatment at 600°C the work is taken of the furnace and freely cooled in the air. But ordinarily hardening is not necessary.

13. Polishing
The alloy may easily be polished. Polishing is carried out in usual way. The hard oxide layer in some sections of the work may be removed using a soft diamond sharpener. Those parts shall be smoothed using rubber discs / rods. Final polishing may be carried out using leather, horsehair or linen discs and polishing paste.

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14. Example: The procedure of application of the VITA **VM13** ceramic material on the Safibond alloy

- Prior to firing, working and sandblasting of the Safibond alloy, in accordance with section 7. of these instructions, is carried out.
- Then, the alloy is cleaned with hot steam in accordance with section 8. these instructions.
- After that an oxidation of the surface is carried out in accordance with section 9. these instructions
- The firing procedure is given in the following table.
- We strongly recommend **slow cooling** after ceramics firing!
- After each firing the work should be cleaned with hot steam.

	Drying temperature (starting temp.) [°C]	Drying period [min.]	Heating time [min.]	Speed of temperature increasing [°C/min.]	Firing temp erature [°C]	Firing time [min.]	Vacuum mainten ance time [min.]
Oxidation	600	0,00	5,00	70	960	3,00	5,00
Thin sparse layer of the Wash Opaque ceramics (powder) firing	500	2,00	5,12	75	890	2,00	5,12
Opaque ceramics (powder) firing	500	2,00	5,12	75	890	2,00	5,12
EFFECT LINEAR material firing	500	6,00	7,05	55	890	1,00	7,05
1st firing of the dentine ceramics	500	6,00	7,05	55	880	1,00	7,05
2nd firing of the dentine ceramics	500	6,00	7,05	55	870	1,00	7,05
Enamel firing of Vita Akzent	500	4,00	4,45	80	880	1,00	-
Corrective firing of Corrective	500	4,00	6,00	50	800	1,00	6,00