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TANAKA DENSHI KOGYO K.K.
Material Safety Data Sheet

1. Identification

Product Name: **Silver Alloy Bonding Wire (SEA type)**

Manufacturer: TANAKA DENSHI KOGYO K. K.
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Recommended application and use restriction: Bonding wire material for semiconductor package.

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2. Hazards Identification

GHS classification

Physical hazards:

Explosives	: Out of classification target.
Flammable gases	: Out of classification target.
Flammable aerosols	: Out of classification target.
Oxidizing gases	: Out of classification target.
Gases under pressure	: Out of classification target.
Flammable liquids	: Out of classification target.
Flammable solids	: Out of category. (Ag) Impossible to classify. (Au)(Pd)
Self-reactive substances	: Out of classification target.
Pyrophoric liquids	: Out of classification target.
Pyrophoric solids	: Out of category. (Ag) Impossible to classify. (Au)(Pd)
Self-heating substances	: Out of category. (Ag) Impossible to classify. (Au)(Pd)
Substances which, in contact with water, emit flammable gases	: Out of category. (Ag) Impossible to classify. (Au)(Pd)
Oxidizing liquids	: Out of classification target.
Oxidizing solids	: Impossible to classify
Organic peroxides	: Out of classification target.
Substances corrosive to metals	: Out of category. (Ag) Impossible to classify. (Au)(Pd)

Health hazards:

Acute toxicity - oral	: Out of category. (Ag) Impossible to classify. (Au)(Pd)

Acute toxicity - dermal	: Out of category. (Ag) Impossible to classify. (Au)(Pd)
Acute toxicity - inhalation (gases)	: Out of classification target.
Acute toxicity - inhalation (vapors)	: Out of classification target.
Acute toxicity - inhalation (dust / mists)	: Impossible to classify.
Skin corrosion / Irritation	: Out of category. (Ag) Impossible to classify. (Au)(Pd)
Serious eye damage / irritation	: Category 2B. (Ag) Impossible to classify. (Au)(Pd)
Respiratory sensitization	: Impossible to classify.
Skin sensitization	: Category 1. (Ag) Impossible to classify. (Au)(Pd)
Germ cell mutagenicity	: Impossible to classify.
Carcinogenicity	: Impossible to classify.
Reproductive toxicity	: Impossible to classify.
Target organ systemic toxicity (single exposure)	: Category 1. (respiratory system) (Ag) Impossible to classify. (Au)(Pd)
Target organ systemic toxicity (repeated exposure)	: Category 1. (eye) (Ag) Category 1. (respiratory organ: inhalation) (Ag) Impossible to classify. (Au)(Pd)
Aspiration toxicity	: Impossible to classify.
Environmental hazards:	
Acute aquatic toxicity	: Impossible to classify.
Chronic aquatic toxicity	: Impossible to classify.

GHS label elements

Pictograms or symbols:

Signal word : Danger

Hazard statements : [Au] - Possible to cause skin allergy.
- On inhalation, possible to cause allergy or asthma.
- In reaction with aqua regia, it generates harmful NOx gas.

[Ag] - Irritation to the eyes.
- Risk of causing allergic skin reaction.
- Damage to respiratory system.
- Damage to the eyes or respiratory organ (inhalation) due to

long-term or repetitive exposure.

[Pd] - No information available.

Precautionary statements

Safety measures : - Do not inhale dust, fume, or mists.
- Wash the hands carefully after handling.

First-aid : - In case of inhalation, remove a victim to fresh air for taking a rest in a posture of easy breathing.
- In case of feeling sick, seek medical diagnosis / attention.

Storage : - Store the product in a product container (spool case) as it was supplied.
- Store the product at a place under temperature of 10-30°C and humidity of 70% or below.
- Store under locking-up.

Disposal : For the disposal of contents or containers, entrust it to an industrial waste disposal firm with the license of a regional governor.

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3. Composition / Information on Ingredients

Chemical identity (single substance or mixture): Single substance (alloy).
Chemical name or general name: Silver (Ag)・Gold (Au)・Palladium (Pd) alloy
Alias: ---
Chemical formula: 89.3%Ag – 7.2%Au - 3.5%Pd
Content: Silver 89.3 wt% + Gold 7.2 wt% + Palladium 3.5 wt%
CAS No.: 7440-22-4 (Ag), 7440-57-5 (Au), 7440-05-3 (Pd)

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4. First-aid Measures

Inhalation : - Remove a victim to fresh air for taking a rest in a posture of easy breathing.
- In case of still feeling sick, seek medical attention.

Skin contact : - Flush with a large amount of water and soap.
- If there is skin irritation or rash developed, seek medical diagnosis / attention.

Eye contact : - Flush with clean running water for 15 min.
- When using contact lens, remove them and continue flushing.

Ingestion : - Rinse the inside of the mouse.
- In case of still feeling sick, seek medical attention.

Anticipated acute symptoms and delayed symptoms: Ingestion: Coughing and throat ache.
Eyes : Eye ache.

Most serious sign and symptoms : No information available.

Protection of nursing persons : No information available.

Special recommendation for medical attendants : No information available.

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5. Firefighting Measures

Suitable extinguishing media : Water spraying, and powder extinguisher.
Unsuitable extinguishing media : No information available.
Specific hazards: : No information available.
Specific firefighting procedures : No information available.
Specific protection for firefighters : In firefighting work, wear a suitable respiratory apparatus and protective clothing for chemicals.

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6. Accidental Release Measures

Personal precautions:
Protective equipment : Gather the leakage using an electric cleaner or broom.
Environmental precautions : No information available.
Collection or neutralization : Collect the leakage into a closely sealable container.
Containment and cleanup : No information available.
Prevention of secondary disaster : No information available.

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7. Handling and Storage

Handling:

Technical measures:

- Apply the engineering measures described in "Chapter 8: Exposure Controls / Personal Protection," and wear personal protective equipment.

Local ventilation & total ventilation:

- Apply the local ventilation and total ventilation described in "Chapter 8: Exposure Controls / Personal Protection."

Precautions for safe handling:

- Avoid the inhalation of dust and mists.
- Wash the hands carefully after handling this product.
- Do not eat, drink, or smoke while handling this product.
- Avoid the release to environment.
- Avoid contact with the eyes.

Conditions to avoid:

- Refer to the descriptions in "Chapter 10: Stability and Reactivity."

Storage:

Technical measures

- No need of special technical measures.

Materials to avoid:

- Refer to the descriptions in "Chapter 10: Stability and Reactivity.

Storage condition

- Store the product at a place temperature of 10-30°C and humidity of 70% or below.
- Store under locking-up.

Safe packaging material:

- Store the product in a product container (spool case) as it was supplied.

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8. Exposure Controls / Personal Protection

Administrative levels:

- Not established.

Acceptable concentration (permissible exposure limit & biological exposure index)

- ACGIH(2005)
  - TLV-TWA 0.1mg/m3 (Ag)
  - Not established. (Au)(Pd)

Engineering measures:

- Install an eye washer near the handling site.

Personal protective equipment:

- For respiratory organ: Wear a suitable respiratory protection equipment.
- For hands: Wear suitable protective gloves.
- For eyes: Wear suitable protective glasses.
- For skin and body: Wear suitable protective clothing.

Sanitary measures:

- Wash the hands carefully after handling.

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9. Physical and Chemical Properties

Physical condition	: Solid.
Shape	:Linear state with circular cross-section.
Color	: Lustrous silver.
Odor	: No data available.
pH	: No data available.
Melting point / solidifying point	: 1020°C
Boiling point / initial boiling point / boiling range	: 2163°C (Ag), 2710°C (Au), 2927°C (Pd)
Flash point	: No data available.
Combustion or explosion limit	: No data available.
Vapor pressure	: 0.000000565Pa(25°C) (Ag) No data available. (Au)(Pd)
Vapor density (air = 1)	: No data available.
Specific gravity (relative density)	: 10.91 (g/cm^3)
Solubility	: Insoluble in water.
n-Octanol – water partition coefficient	: No data available.
Spontaneous ignition temperature	: No data available.
Decomposition temperature	: No data available.
Threshold value for odor	: No data available.
Evaporation velocity (butyl acetate = 1)	: No data available.

Flammability (solid, gas)	: No data available.
Viscosity	: No data available.

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10. Stability and Reactivity

Stability:

[Ag] - Stable under normal condition.

[Au] - Considered to be stable under normal storage and handling.

- With weak chemical reactivity, this product does not react with oxygen (O_2), sulfur (S) or common alkalis / acids.
- Since this product reacts with halogens, it dissolves in aqua regia, which generates chlorine (Cl_2).
- Under existence of oxygen (O_2), it dissolved in the solution containing cyan ions (CN^-), forming complex ions $[Au(CN)_2]$.

[Pd] - Stable at usual condition.

Hazard reaction probability:

[Ag] - Turns black with exposure to ozone, hydrogen sulfide, or sulfur. Avoid contact with strong acids or strong alkalis. Reaction with acetylene forms a compound sensitive to impact. Mixture of fine fragments of silver and concentrated aqueous hydrogen peroxide solution may cause explosion (oxygen gas is released after vigorous decomposition). Contact with ammonia under dry condition may form an explosive compound. Reaction with dilute nitric acid or concentrated sulfuric acid easily occurs, posing a risk of fire.

[Au] - In reaction with aqua regia, this product generates hazardous NOx gas.

[Pd] - A mass of material is noninflammable. However, minute powder is flammable and it is possible to cause noxious fume by heating in case of a fire.

Conditions to avoid:

- Contact with materials to avoid.

Materials to avoid:

[Ag] - Strong acids, strong alkalis, concentrated aqueous hydrogen peroxide solution, ammonia (dry condition), dilute nitric acid, and concentrated sulfuric acid.

[Au] - Aqua regia.

[Pd] - No information available.

Hazardous decomposition products: - No information available.

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11. Toxicological Information

Acute toxicity

Oral	: Rat LD50 > 5000mg/kg (Ag) No information available. (Au)(Pd)
Dermal	: Rat LD50 > 2000mg/kg (Ag) No information available. (Au)(Pd)

Inhalation (gases) : No information available.
Inhalation (vapors) : No information available.
Inhalation (dust / mists) : No information available.

Skin corrosion / irritation
[Ag] A paper reported that a test using rabbits had caused minor irritation.
[Au] Shows tumor-triggering property according to animal tests.
[Pd] No information available.

Serious eye damage / irritation
[Ag] A paper reported that a test using rabbits had caused minor irritation, but it had disappeared 48 h later. Eye irritation (Category 2B).
[Au][Pd] No information available.

Respiratory sensitization : No information available.

Skin sensitization
[Ag] Exposure to this powder causes allergic contact dermatitis. A paper reported that contact with accessories containing silver had caused allergic reaction.
[Au][Pd] No information available.

Germ cell mutagenicity : No information available.

Carcinogenicity
[Ag] No information exists from classification / evaluation organizations such as IARC. In a test of intramuscular injection of the powder into rats did not show carcinogenicity. No evidence exists about carcinogenicity on humans.
[Au][Pd] No information available.

Reproductive toxicity : No information available.

Target organ systemic toxicity (single exposure)
[Ag] With exposure to heated metallic silver vapor for four hours, damage to the lung accompanied by emphysema occurred. Occupational exposure to the dust causes the stimulation to the respiratory tract. Damage to respiratory system (Category 1).
[Au][Pd] No information available.

Target organ systemic toxicity (repeated exposure)
[Ag] A paper reported that occupational exposure to the dust had caused argyria where pigment deposits on the skin and mucosa, but the trouble that appeared as functional disorder had been nighttime visibility. Therefore, Category 1 (eyes) was assigned. A paper reported that the deposition of the dust on the lung due to long-term exposure had caused bronchitis.

Therefore, Category 1 (respiratory organ; inhalation) was assigned. Damage to the eyes and respiratory organ (inhalation) due to long-term or repetitive exposure (Category 1).

[Au][Pd] No information available.

Aspiration toxicity : No information available.

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12. Ecological Information

Acute toxicity against aquatic environment : No information available.

Chronic toxicity against aquatic environment : No information available.

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13. Disposal Considerations

Residue waste:

- Dispose of the waste following the standards of related regulations and the standards of a regional government.
- Entrust the disposal to an industrial waste disposal firm with the license or a local public agency if any..

Polluted containers and packaging:

- Recycle the container after cleaning, or disposed of it following the related regulations, or the standards of a regional government.

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14. Transport Information

International regulations:

UN number (UN transport name) : Not applicable.

UN product name (UN transport name) : Not applicable.

UN classification (hazard class) : Not applicable.

Marine regulation information : Not applicable.

Air regulation information : Not applicable.

Regulations in Japan:

Land transport information : Not applicable.

Marine transport information : Not applicable.

Air transport information : Not applicable.

Marine transport information : Not applicable.

Specific safety measures:

- In transportation, avoid direct sunlight, load containers without breakage, corrosion, or contamination, and ensure load collapse countermeasures.
- Do not load on the container.

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15. Regulatory Information

Our product does not contain the substances prohibited in RoHS instruction and REACH.

16. Other information

Reference (* mark: Japanese version)

1) Hazard Handbook for Chemical Substances, Fourth Edition*
Supervised by The Industrial Safety and Health Department of The Ministry of Health, Labour and Welfare: Edited and published by Japan Industrial Safety & Health Association.

2) Threshold Limit Values for Chemical Substances and Physical Agents, and Biological Exposure Indices (1998): Published by ACGIH.

3) Recommendation on Permissible Exposure Limit, etc. (1999)*
Journal of Japan Society for Occupational Health Vol. 41, P96-120 (1999): Published by Japan Society for Occupational Health.

4) Safety Data Book for Chemical Substances*
Edited by Chemical Substance Safety Information Research Group under supervision of Yoichi Ueno: Published by Ohmsha, Ltd.

5) Hazardous Chemicals Desk Reference: Written by N. I. Sax and Richard J. Lewis, Sr.
Japanese version*: Translated under supervision of Shizuo Fujiwara: Published by Maruzen Co., Ltd.

6) Handbook of Reactive Chemical Hazards: Written by L. Bretherick
Japanese version*: Translated under supervision of Tadao Yoshida and Masamitsu Tamura: Published by Maruzen Co., Ltd.

7) Handbook for Dangerous Materials*
Tetsu Yamamoto: Published by Shinsei Publishing Co., Ltd.

8) Data Book for Dangerous Materials*
Written and edited by Tokyo Fire Protection Association under supervision of Tokyo Fire Department: Published by Maruzen Co., Ltd.

9) Science of Precious Metals*
Edited under supervision of Seiichiro Tanaka, Taira Suzuki, Kenjiro Meguro: Published by Tanaka Kikinzoku Kogyo K. K.

10) Story of Precious Metals*
Written and edited by Hironobu Yamamoto: Published by Gihodo Shuppan Co., Ltd.

11) Handbook for Regulations on Chemical Product Application*
Published by The Chemical Daily Co., Ltd.

12) Chemistry Handbook (Basic Chemistry Version)*
Edited by The Chemical Society of Japan: Published by Maruzen Co. Ltd.

13) Dictionary for Elements*
Edited by Hisao Mabuchi: Published by Asakura Publishing Co., Ltd.

14) Encyclopaedia Chimica
Edited by Editing Committee for Encyclopaedia Chimica: Published by Kyoritsu Shuppan Co., Ltd.

15) Data Book for Metals*
Edited by The Japan Institute of Metals: Published by Maruzen Co., Ltd.

16) New Chemical Index (2000)*

Published by The Chemical Daily Co., Ltd.

17) Chemical Risk Information Platform (CHRIP) of The National Institute of Technology and Evaluation
http://www.safe.nite.go.jp/japan/db.html

18) NIST Chemistry WebBook
http://webbook.nist.gov/chemistry/

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