

SAFETY DATA SHEET

Section 1 – Products and Suppliers

SDS: TiH Pastes-FL2-101B (04-2016)

- Product Identifier:** Brazing Alloy Pastes with titanium hydride and flammable organic binders
- Other means of identification:** Wesgo Metals® Products: See Table 1 in Section 16 for specific products and their respective metal constituents.
- Use (and restrictions):** Metal alloys for joining or repairing metal components by brazing/soldering.

Suppliers and emergency contact information:

Morgan Advanced Materials/Wesgo Metals®
2425 Whipple Road
Hayward, California 94544 USA
+1-510-491-1100
0800-1700hrs local time, Mon-Fri.
mtchayward.msds@morganplc.com

SDS Date: 21 April 2016. Replaces previous version (SDS: TiH Pastes-FL2-101B) dated 26 Jan 2016.

Section 2 – Hazard Identification

These products are sold in a paste-like form in small containers and syringes. These products contain flammable solvents and should be stored in sealed containers when not in use and kept away from ignition sources and hot surfaces. Flammable solvent vapors, metal fumes and dust are generated during melting and brazing operations. Hazardous levels of dust or metal fumes of product constituents can create health risks, as described below. Metallic dust and particles can cause a serious fire and/or explosion hazard.

2.1 Classification

Under the Globally Harmonized System of Classification and Labeling and the US OSHA Hazard Communication Standard, dust and fumes released during brazing operations are categorized as hazardous: (incl. Classification according to Regulation (EC) No 1272/2008 [CLP])

| | | |
|-------------------------------------|------|---|
| Highly flammable liquid, Category 2 | H225 | Flashpoint < 23°C/73.4°F and initial boiling point > 35°C/90°F |
| Eye irritant, Category 2B | H319 | due to the presence of ethanol and/or isopropyl alcohol and indium (in AgCuIn+0.6%TiH-EP, Incusil+3TiH-EP, and Incusil-ABA) |

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2.2 Signal word, symbols, hazard and precautionary statements:

Danger



Hazard Statements:

H225 Highly flammable liquid and vapor.
H319 Causes eye irritation.

Note: Accompanying alpha-numeric designations included to address EU regulations.

Precautionary Statements:

P210 Keep away from heat/sparks/open flames/hot surfaces. – No smoking.
P280A + P264 Wear protective gloves to prevent skin contact or thermal burns during brazing operations. Wash hands thoroughly after handling.
P280B Wear ANSI-approved eye protection to prevent eye contact.
P305 + P351 + P338 + P337 + P313 **If in eyes:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If eye irritation persists: Get medical attention.
P308 + P309 + P313 **If exposed, concerned, or feel unwell:** Get medical advice/attention.

Other information about health hazards:

Dust and fumes generated during brazing operations can cause skin and eye irritation. Repeated or prolonged exposure to elevated concentrations of any airborne dust or fume can irritate or harm the respiratory system, especially as an aggravation to a pre-existing condition. Inhalation of significant quantities of very fine metal dust and metal fumes can cause “metal fume fever,” with flu-like symptoms. Avoid creating and breathing airborne dust and fumes.

Other information about physical hazards:

Brazing and soldering operations present a fire hazard to nearby combustible materials. Finely dispersed metal particles can form ignitable and explosive mixtures in air. Maintain good housekeeping.

Section 3 – Composition/Information on Ingredients

3.1 Mixtures:

See Table 1 in Section 16 for specific products and their respective metal constituents.

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| Constituents | CAS Registry No. | EINECS No. | Constituents ⁽¹⁾ | CAS Registry No. | EINECS No. |
|---------------|------------------|------------|-----------------------------|------------------|------------|
| Aluminum (Al) | 7429-90-5 | 231-072-3 | Isopropyl alcohol | 67-63-0 | 200-661-7 |
| Copper (Cu) | 7440-50-8 | 231-159-6 | Silicon (Si) | 7440-21-3 | 231-130-8 |
| Ethanol | 64-17-5 | 200-578-6 | Silver (Ag) | 7440-22-4 | 231-131-3 |
| Glycerol | 56-81-5 | 200-289-5 | Tin (Sn) | 7440-31-5 | 231-141-8 |
| Indium (In) | 7440-74-6 | 231-180-0 | Titanium Hydride | 7704-98-5 | 231-726-8 |

| Binder | Binder Ingredients | | | |
|--------|--------------------|----------|-------------------|------------------|
| | Ethanol | Glycerol | Isopropyl Alcohol | Propylene Glycol |
| FC-10 | X | X | | |
| FC-11 | | | X | X |
| FC-12 | | | X | X |
| FC-16 | | X | X | X |

Section 4 – First Aid Measures

4.1 Description of first aid measures

| | |
|--|---|
| Inhalation: | Remove affected personnel to an exposure-free environment. If experiencing respiratory symptoms: Call a poison center or doctor if you feel unwell. |
| Skin contact: | Wash hands with soap and water. If skin irritation or rash occurs: Get medical advice/attention. |
| Eye contact | Flush eyes with plenty of water. Remove contact lenses, if present and easy to do. Continue rinsing. If necessary call a specialist. |
| Ingestion: | Not applicable. |
| Indication of need for immediate medical attention and special treatment: | Skin contact with hot metals or flames during brazing operations can cause thermal burns. Seek medical attention for severe thermal burns. |

4.2 Most important symptoms and effects, both acute and delayed

No further relevant information available.

4.3 Indication of any immediate medical attention and special treatment needed

No further relevant information available.

Section 5 – Fire Fighting Measures

5.1 Extinguishing media

Suitable extinguishing media:

Use dry chemical or carbon dioxide.

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Unsuitable extinguishing media:

Do not use water on a metal fire.

5.2 Special hazards arising from the substance or mixture

Combustion hazards:

Products contain flammable solvents. Containers should be kept sealed when not in use. Keep away from heat/sparks/open flames/hot surfaces during storage and use. Flames from brazing operations can ignite combustibles. In a finely divided form, this product may ignite when exposed to flames or by reaction with incompatible materials. Metal oxides or fumes of constituent metals may be emitted during a fire.

5.3 Advice for firefighters

Special fire-fighting procedures:

Use protective clothing and breathing equipment appropriate to the surrounding fire.

Unusual fire and explosion hazards:

Metal powder mixtures can cause fires and/or explosions when present in air at high concentrations.

Section 6 – Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures

No special measures required.

6.2 Environmental precautions:

No special measures required.

6.3 Methods and material for containment and cleaning up:

Metal scrap should be collected and contained using normal procedures. Metal particulates, shavings, powders and granules should be cleaned up using wet-sweeping methods to avoid creating dust. Vacuum only with HEPA filtered equipment. **Do not** use compressed air for clean-up. Some fine metal powders may ignite or explode under specific conditions; avoid creating high airborne dust concentrations and accumulating dust. Appropriate personal protective equipment should be used when cleaning up dust. Recovered material should be placed in sealed containers and recycled for their metal content. Dispose in accordance with applicable waste disposal regulations.

6.4 Reference to other sections

See Section 7 for information on safe handling.

See Section 8 for information on personal protection equipment.

See Section 13 for disposal information.

Section 7 – Handling and Storage

7.1 Precautions for safe handling

Avoid skin contact; wash hands after handling chemicals. Do not eat, drink or smoke while handling these

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products. All employees who handle this material should be trained to handle it safely. Maintain good housekeeping practices, such as wet sweeping or vacuuming to remove dust accumulation. Avoid dust inhalation or ingestion and contact of materials with eyes. Certain metal powder mixtures can cause fires and/or explosions when present in air at high concentrations.

7.2 Conditions for safe storage, including any incompatibilities

Store in closed containers in a cool, dry, well-ventilated, fire-resistant area away from oxidizing agents and sources of heat and ignition.

7.3 Specific end use(s)

No further relevant information available.

Section 8 – Exposure Controls and Personal Protection

8.1 Control parameters

Exposure limits and guidelines:

| Constituents | OSHA PEL 8-Hr TWA | ACGIH TLV 8-Hr TWA |
|-------------------|--|--|
| Aluminum (Al) | 15 mg/m ³ (total dust) 5 mg/m ³ (respirable fraction) | 1 mg/m ³ (inhalable fraction) |
| Copper (Cu) | 1 mg/m ³ (dust); 0.1 mg/m ³ (fume) | 1 mg/m ³ (dust); 0.2 mg/m ³ (fume) |
| Ethanol | 1000 PPM | 1000 PPM |
| Glycerol | 15 mg/m ³ (total dust) 5 mg/m ³ (respirable fraction) | 10 mg/m ³ |
| Indium (In) | None established | 0.1 mg/m ³ |
| Isopropyl alcohol | 400 PPM | 200 PPM; 400 PPM (STEL) ^{Note 1} |
| Propylene glycol | None established | None established |
| Silicon (Si) | 15 mg/m ³ (total dust) 5 mg/m ³ (respirable fraction) | Withdrawn due to insufficient data |
| Silver (Ag) | 0.01 mg/m ³ | 0.1 mg/m ³ |
| Tin (Sn) | 2 mg/m ³ | 2 mg/m ³ |
| Titanium hydride | None established | None established |

Other jurisdictions may have different exposure limits and control guidelines. Users are advised to consult and comply with local regulations.

¹STEL (Short Term Exposure Limit) - A 15-minute TWA exposure that should not be exceeded at any time during the workday.

8.2 Exposure controls

Engineering controls:

Use local exhaust ventilation during brazing operations to minimize or eliminate concentrations of airborne contaminants.

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Personal protective equipment:

Wear ANSI-approved eye protection to prevent eye contact. Wear protective gloves to prevent skin contact or thermal burns during brazing operations. Use NIOSH-approved respiratory protective equipment if exposures exceed established limits or guidelines.

General hygiene considerations:

Do not eat, drink or smoke when handling these products. Wash hands after handling these products.

Limitation and supervision of exposure into the environment

The legal issue values and limitations are to be paid attention!

Section 9 – Physical and Chemical Properties

9.1 Information on basic physical and chemical properties

| | | | |
|---|---------------------------------|-----------------------------------|---------------------|
| Appearance: | Colors vary according to metals | Odor: | Slight alcohol odor |
| Odor threshold: | Not applicable | pH: | Not applicable |
| Melting point: | Not applicable | Boiling point: | Not applicable |
| Flash point: | See table below | Evaporation rate: | Not applicable |
| Flammability: | Not applicable | LEL/UEL: | Not applicable |
| Vapor pressure: | Not applicable | Vapor density: | Not applicable |
| Relative density: | Not applicable | Water solubility: | Not applicable |
| Partition coefficient (n-octanol/water): | Not applicable | Auto ignition temperature: | Not applicable |
| Decomposition temperature: | Not applicable | Viscosity: | Not applicable |

Flashpoint data for paste binders (See Table 1 in Section 16 for specific products and gel binders):

| Gel Binders | | |
|---------------|---------------|---------------|
| FC-10 | FC-11/12 | FC-16 |
| ≥70°F / ≥21°C | ≥59°F / ≥15°C | ≥63°F / ≥17°C |

9.2 Other information

No further relevant information available.

Section 10 – Stability and Reactivity

10.1 Reactivity

10.2 Chemical stability

Braze alloy products are stable when stored in closed containers at room temperature under normal storage and handling conditions.

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10.3 Possibility of hazardous reactions

Heating to elevated temperatures may liberate metal/metal oxide fumes (i.e., during brazing operations). Metal powder mixtures can cause fires and explosions (if present at high airborne concentrations).

10.4 Conditions to avoid:

Avoid open flames around fine metal powders.

10.5 Incompatible materials:

Metals in particulate form are typically incompatible with strong acids and strong oxidizing agents.

10.6 Hazardous decomposition products:

No dangerous decomposition products known.

Section 11 – Toxicological Information

11.1 Information on toxicological effects

User-generated dusts and fumes may, on contact with the skin or eyes, produce mechanical irritation. Chronic exposures could cause dermatitis (skin) or conjunctivitis (eyes). Excessive inhalation of powders or user-generated fumes from welding/ brazing with these products may, depending on the specific features of the process used, pose a long-term health hazard. The composition of fumes and gases generated in user operations will depend on the metal alloy, base metal and the specific process being used and may include metals, metal oxides, carbon monoxide, ozone, and oxides of nitrogen.

Additional toxicological information is available through the U.S. National Institute for Occupational Safety and Health (NIOSH) and the Registry of Toxic Effects of Chemical Substances (RTECS).

See website: <http://www.cdc.gov/niosh/ipcsneng/nengrtec.html>. Applicable product constituents and their respective RTECS numbers are listed below:

| | | | | | |
|----------|-----------|-------------------|-----------|------------------|-----------|
| Aluminum | BD0330000 | Indium | NL1050000 | Silver | VW3500000 |
| Copper | GL5325000 | Isopropyl alcohol | NT8050000 | Tin | XP7320000 |
| Ethanol | KQ6300000 | Propylene glycol | TY2000000 | Titanium hydride | XR2130000 |
| Glycerol | MA8050000 | Silicon | VW0400000 | | |

Section 12 – Ecological Information

12.1 Toxicity

When used in their intended manner, these products would not be expected to be released to the environment. Adverse effects on ecosystems are not anticipated under normal and recommended conditions of handling, use, storage and disposal. None of the constituents in these products are classified as environmentally persistent, bio-accumulative toxic chemicals. Copper is a marine pollutant. Silver is an environmental pollutant.

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Section 13 – Disposal Considerations

13.1 Waste treatment methods

Manage waste materials in accordance with applicable waste and disposal regulations. Whenever possible, try to recycle and reclaim due to the intrinsic value of certain braze alloy constituents. Whatever cannot be saved for recovery or recycling should be shipped to a permitted waste management facility. Certain products may contain silver, which could cause them to be a hazardous waste as defined by US EPA RCRA regulations, if disposed instead of recycled. Process, use or contamination of this product may change the characteristics of the waste and, consequently, how the waste is managed.

Section 14 – Transport Information

Braze alloy paste products contain gel binders that consist of ethanol or isopropyl alcohol and are regulated by the U.S. Department of Transportation.

| Product Binder | UN Number | UN Proper Shipping Name | Hazard Class | Packing Group |
|----------------|-----------|--|--------------|---------------|
| FC-10 | 1993 | Flammable liquids, n.o.s. (contains ethanol) | 3 | III |
| FC-11, 12 & 16 | 1993 | Flammable liquids, n.o.s. (contains isopropyl alcohol) | 3 | III |

Special precautions for user

See Section 6 – 8.

Section 15 – Regulatory Information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

- Copper and silver in dust form are hazardous substances as defined by the U.S. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).
- All brazing product components are listed on the U.S. Toxic Substances Control Act (TSCA) inventory.
- Certain braze alloy products contain copper and silver, which are subject to the reporting requirements of Section 313 of the U.S. Emergency Planning and Community Right-to-Know Act (SARA Title III). Please refer to Table 1 in Section 16 for applicable products.

Section 16 – Other Information

Revision Summary: 15 April 2015: SDS revised to comply with US OSHA Hazard Communication Standard and GHS requirements.

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26 Jan 2016: Alpha-numeric designations added to Section 2 hazard statements.
21 April 2016: SDS enhanced to comply with Regulation (EC) No 1272/2008 [CLP].

| Paste Products | Binder Type | Binder % | TABLE 1 COMPOSITION - % WEIGHT | | | | | | |
|-------------------|-------------|----------|--------------------------------|----|----|----|----|----|-----|
| | | | Al | Ag | Cu | In | Si | Sn | TiH |
| AgCuIn+0.6%TiH-EP | FC-11 | 10 | | 53 | 24 | 12 | | | 1 |
| Copper-ABA | FC-11 | 10 | 2 | | 83 | | 3 | | 2 |
| Copper-ABA+13Ti | FC-11 | 10 | 1 | | 62 | | 2 | | 10 |
| Cusil-ABA | FC-11 | 10 | | 56 | 32 | | | | 2 |
| Cusin-1-ABA | FC-11 | 10 | | 57 | 30 | | | 1 | 2 |
| Incusil+3TiH-EP | FC-11 | 10 | | 52 | 24 | 11 | | | 3 |
| Incusil-ABA | FC-16 | 10 | | 52 | 24 | 12 | | | 2 |
| Incusil-ABA | FC-11 | 10 | | 52 | 24 | 12 | | | 2 |
| Incusil-25-ABA | FC-11 | 10 | | 40 | 25 | 22 | | | 2 |
| Silver-ABA | FC-11 | 10 | 1 | 84 | 4 | | | | 1 |
| Ticusil | FC-16 | 10 | | 62 | 24 | | | | 4 |

Reasonable care has been taken in the preparation of information contained in this Safety Data Sheet and the information is provided in good faith. Information provided in this Safety Data Sheet has been prepared by competent and appropriately qualified and trained persons according to the US OSHA Hazard Communication Standard. Morgan Advanced Materials - Wesgo Metals® assumes no responsibility as to the accuracy of information drawn from other sources. No warranty, expressed or implied, is made.

Abbreviations and acronyms

| | |
|--------|--|
| ANSI | American National Standards Institute |
| ACGIH | American Conference of Governmental Industrial Hygienists |
| CAS | Chemical Abstracts Service (division of the American Chemical Society) |
| EINECS | European Inventory of Existing Commercial Chemical Substances |
| HEPA | High-efficiency particulate air filters |
| NIOSH | National Institute of Occupational Safety and Health |
| OSHA | Occupational Safety and Health Administration |
| PEL | Permissible exposure limit |
| RCRA | Resource Conservation and Recovery Act |
| TLV | Threshold Limit Values |
| TWA | Time-weighted Average |