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Material Safety Data Sheet

Copper / Copper Alloys

MATERIAL SAFETY DATA SHEET

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SECTION I. MATERIAL IDENTIFICATION

Copper/Copper Alloys

See attached alloy composition sheets for alloy presence and percentages of alloying ingredients.

SECTION II. HAZARDOUS INGREDIENTS

Copper/Copper Alloys

| | <u>CAS Number</u> | | <u>OSHA-PEL 8-hr TWA</u> | <u>ACGIH-TLV 8-HR TWA (1984-85)</u> | <u>ACGIH STEL (1984-85)</u> |
|------------------|-------------------|------------------|--|--|-------------------------------------|
| Aluminum | (7429-90-5) | (Dust) (Fume) | -- -- | 10 mg/m ³ 5 mg/m ³ | 20 mg/m ³ -- |
| Antimony | (7440-36-0) | | 0.5 mg/m ³ | 0.5 mg/m ³ | -- |
| Arsenic | (7440-38-2) | | 0.5 mg/m ³ | 0.02 mg/m ³ | -- |
| Beryllium | (7440-41-7) | | 0.002 mg/m ³ | 0.002 mg/m ³ | -- |
| Cadmium | (7440-43-9) | (Dust) (Fume) | 0.2 mg/m ³ 0.1 mg/m ³ | 0.05 mg/m ³ 0.05 mg/m ³ * | 0.2 mg/m ³ -- |
| Chromium | (7440-47-3) | | 1 mg/m ³ | 0.5 mg/m ³ | -- |
| Cobalt | (7440-48-4) | | 0.1 mg/m ³ | 0.1 mg/m ³ | -- |
| Copper | (7440-50-8) | (Dust) (Fume) | 1 mg/m ³ 0.1 mg/m ³ | 1 mg/m ³ 0.2 mg/m ³ | 2 mg/m ³ -- |
| Iron | (1309-37-11) | | 10 mg/m ³ | 5 mg/m ³ (As iron oxide fume) | 10 mg/m ³ |
| Lead | (7439-92-1) | | 0.05 mg/m ³ | 0.15 mg/m ³ | 0.45 mg/m ³ |
| Manganese | (7439-96-5) | (Dust) (Fume) | 5 mg/m ³ -- | 5 mg/m ³ 1 mg/m ³ | -- 3 mg/m ³ |
| Nickel | (7440-02-0) | | 1 mg/m ³ | 1 mg/m ³ | -- |
| Phosphorus | (7723-14-0) | | 0.01 mg/m ³ | 0.01 mg/m ³ | 0.03 mg/m ³ |
| Silicon | (7440-21-3) | | (1) | (2) | 20 mg/m ³ |
| Silver | (7440-22-4) | | 0.01 mg/m ³ | 0.1 mg/m ³ | -- |
| Sulphur (Yellow) | (7704-34-9) | | 13 mg/m ³ | 5 mg/m ³ | 5/10 mg/m ³ |
| Tellurium | (13494-80-9) | | 0.1 mg/m ³ | 0.01 mg/m ³ | -- |
| Tin | (7440-31-5) | | 2 mg/m ³ | 2 mg/m ³ | 4 mg/m ³ |
| Zinc | (1314-13-2) | (Dust) (Fume) | -- 5 mg/m ³ | (2) 5 mg/m ³ | -- 10 mg/m ³ |
| Zirconium | (7440-67-7) | | 5 mg/m ³ | 5 mg/m ³ | 10 mg/m ³ |

*Ceiling Limit

Note: antimony trioxide, beryllium, cadmium, chromium, cobalt-chromium alloy, lead and nickel have been identified as potential human carcinogens.

SECTION III. PHYSICAL DATA

| | | | |
|--------------------------|---|---------------------------------|-------------------------|
| Physical Form: | Solid | Specific Gravity: | 7.45 - 9.00 |
| Boiling Point: | Not Applicable | Vapor Density | Not Applicable |
| Freeze-Melt Temperature: | Approximately 1290 ^o - 2260 ^o F | Solubility in H ₂ O: | Insoluble |
| Vapor Pressure: | Not Applicable | Color: | Silver or Yellow to Red |
| Evaporation Rate: | Not Applicable | Odor: | None |

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point: (Method Used) Not Applicable
Flammable Limits (LEL-UEL) Not Applicable

Extinguishing Media: See Below
Auto Ignition Temp. - Not Applicable

Special Fire Fighting Procedures: Solid massive form is not combustible. Fire and explosion hazards are moderate when material is in the form of dust and exposed to heat, flames, chemical reaction, or in contact with powerful oxidizers. Use special mixtures of dry chemical or sand. Firefighters should wear self-contained breathing apparatus and protective clothing.

SECTION V. REACTIVITY DATA

Stability: Stable

Conditions to Avoid: Stable under normal conditions of transport and storage. Molten metal may react violently with water.

Incompatibility (Materials to Avoid): Acids, bases, and oxidizers.

Hazardous Decomposition or Byproducts: Metal fume.

Hazardous Polymerization: Will not occur.

SECTION VI. HEALTH HAZARD DATA

Permissible Exposure Limits and Threshold Limit Values. See Section II.

Route(s) of Entry: Inhalation: Yes; Skin: Yes; Ingestion: Yes

Under normal handling conditions the solid alloy presents no significant health hazards. Processing of the alloy by dust or fume producing operation (grinding, buffing, heating, welding, etc.) may result in the potential for exposure to airborne metal particulates or fume. The exposure levels in Section II are relevant to fumes and dusts.

Effects of Overexposure:

Aluminum -- Excessive exposure to aluminum fume and dust has been associated with lung disease, but this effect is probably due to simultaneous silica exposure.

Antimony -- Antimony and its compounds are irritating to the skin and mucous membranes and are systemic poisons. Effects are reported to include metallic taste in the mouth, vomiting, colic, loss of appetite and weight, and diarrhea. In addition, dermatitis may result which starts as an inflammation of the hair follicles and can progress through pus formation and sloughing to leave a contracted scar.

Beryllium -- Inhalation of beryllium dust or fume may result in the production of an acute or chronic systematic disease depending upon the level of exposure and the beryllium compound involved. Granulomatous lesions of the skin, liver, kidneys, spleen, and lymph nodes have been reported.

Damage to the lungs may be in both the acute and chronic forms, both of which have similar signs and symptoms. These include a relatively non-productive cough, progressive difficulty in breathing, loss of appetite, and loss of weight. The major difference between the two is the suddenness of onset and the rate of progression. In the acute form, the symptoms appear in several hours to several weeks after exposure and there is usually rapid progression of signs including dyspnea, anorexia, and extreme weight loss. Complete recovery is possible and fatal cases usually result from acute heart disease. In chronic beryllium disease, the symptoms or signs are generally delayed in their onset and are persistent in nature. They may be triggered or aggravated by stresses such as pregnancy, respiratory infection, and thyrotoxicosis. In the progression of the disease, symptoms of heart disease may occur.

Beryllium is also a suspected human carcinogen and has caused cancer in laboratory animals.

Cadmium -- Inhalation of cadmium fumes may cause respiratory irritation with a sore, dry throat and a metallic taste followed by a cough, chest pain, and difficulty in breathing. Bronchitis, pneumonitis, and pulmonary edema have been reported as a result of the irritation of the fumes. Headaches, dizziness, loss of appetite, and weight loss have also been

reported and the liver, kidneys and bone marrow may be injured by the presence of the metal.

Continued exposure to lower levels of cadmium has resulted in chronic poisoning characterized by irreversible lung damage and kidney damage. A single, high level exposure to cadmium can cause severe lung irritation which may be fatal. Cadmium is also a suspected human carcinogen.

Chromium -- In some workers, chromium compounds act as allergens and may cause dermatitis and may also produce pulmonary sensitization. Chromic acid and chromates have a direct corrosive effect on the skin and the mucous membranes of the upper respiratory tract. Although rare, there may be the possibility of skin and pulmonary sensitization.

IARC has determined that there is sufficient evidence of increased lung cancer among workers in the chromate-producing industry and possible chromium alloy workers. This determination is supported by sufficient evidence for carcinogenicity to animals and possible mutagenicity testing of Cr VI compounds.

Cobalt -- Cobalt has been reported as causing hypersensitization type dermatitis in individuals who are susceptible. Animal studies have shown that particulate cobalt is an acutely irritating substance and industrial exposures, possibly combined with small amounts of silica, are reported capable of producing serious pneumoconiosis which is initially of an insidious nature.

Copper -- Melting, grinding, cutting of copper may produce fumes or dust exposure and breathing these fumes or dust may present potentially significant health hazards. Fumes of copper may cause metal fume fever with flu-like symptoms and skin and hair discoloration. While industrial dermatitis has not been reported, keratinization of the hands and the soles of the feet has been reported. Systemically as well, copper dust and fume cause irritation of the upper respiratory tract, metallic taste in the mouth, and nausea.

Iron -- The inhalation of iron oxide fumes or dust may cause an apparent benign pneumoconiosis which is called siderosis. This disease is reported to be disabling, but makes x-ray diagnosis of other lung conditions difficult or impossible.

Lead -- Short term exposure: Lead is an accumulative poison. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include decreased physical fitness, fatigue, sleep disturbance, headache, aching bones and muscles, constipation, abdominal pains, and decreasing appetite. The effects are reversible and complete recovery is possible. Inhalation of large amounts of lead may lead to seizures, coma, and death.

Lead -- Long term exposure: Long term exposure can result in a buildup of lead in the body and more severe symptoms. These include anemia, pale skin, a blue line at the gum margin, decreased handgrip strength, abdominal pain, severe constipation, nausea, vomiting, and paralysis of the wrist joint. Prolonged exposure may also result in kidney damage. If the nervous system is affected, usually due to very high exposures, the resulting effects include severe headache, convulsions, coma, delirium, and death. Alcohol ingestion and physical exertion may bring on symptoms. Continued exposure can result in decreased fertility and/or increased chances of miscarriage or birth defects.

Manganese -- Chronic manganese poisoning may result from inhalation of dust or fume. The central nervous system is the chief site of the injury. Chronic manganese poisoning is not a fatal disease although it is extremely disabling. Some individuals may be hypersusceptible to manganese. Freshly formed manganese fume has caused fever and chills similar to metal fume fever.

Nickel -- The most common ailment arising from contact with nickel or its compounds is an allergic dermatitis known as "nickel itch" which usually occurs when the skin is moist. Generally nickel and most salts of nickel do not cause systemic poisoning, but nickel has been identified as a suspected carcinogen.

Silicon -- Accumulation in lungs may be responsible for benign pneumoconiosis, but is not considered to be responsible for pulmonary functional impairment or respiratory symptoms.

Tin -- The inhalation of inorganic tin fumes or dust may cause an apparent benign pneumoconiosis called stannosis which is reported not to be disabling.

Zinc (as Oxide) -- Zinc is very low in toxicity but inhalation of fumes may cause "metal fume fever." Onset of symptoms may be delayed 4-12 hours and include irritation of the nose, mouth and throat, cough, stomach pain, headache, nausea, vomiting, metallic taste, chills, fever, pains in the muscles and joints, thirst, bronchitis or pneumonia and a bluish tint to the skin. These symptoms go away in 24-48 hours and leave no effect.

Note: Antimony trioxide, beryllium, cadmium, chromium, cobalt-chromium alloy, lead and nickel have been identified as potential human carcinogens.

Emergency First Aid Procedures:

Eye Contact Flush well with running water to remove particulate. Get medical Attention.

Skin Contact Vacuum off excess dust. Wash well with soap and water.

Inhalation Remove to fresh air. Get medical attention.

Ingestion Seek medical attention if large quantities of material have been ingested.

SECTION VII. PRECAUTIONS FOR SAFE HANDLING OR USE

Steps to be Taken in Case Material is Released or Spilled: No special precautions are necessary for spills of bulk material. If large quantities of dust are spilled, remove by vacuuming or wet sweeping to prevent heavy concentration of airborne dust. If liquids (acids or bases) containing solubilized metal are spilled evacuate unprotected personnel from area. Absorb liquid by means of vermiculite, dry sand or similar material. Follow federal, state, and local regulations concerning the disposal of waste.

Waste Disposal Method: Dispose of in accordance with federal, state, and local regulations. Cleanup personnel should wear respirators and protective clothing. Ventilate area of release.

Precautions to be Taken in Handling and Storing: Store material away from incompatible materials and keep dust from sources of ignition.

Other Precautions: See all other sections of this MSDS.

SECTION VIII. CONTROL MEASURES

Respiratory Protection: If exposure above the PEL or TLV, NIOSH approved respirator for fume or dust, dependent upon the source of airborne contaminant.

Ventilation: Required if dust or fume created in handling or working on this material.

Local Exhaust: Required if dust or fume created in handling or working on this material.

Mechanical (general): As above to reduce airborne dust or fume levels.

Protective Gloves: Required for melt, grind, cut or weld operations. Select glove approved for the specific operation.

Eye Protection: Required for melt, grind, cut, or weld operations. Minimum requirement of safety glasses with side shields for these operations. Melting and welding may require special eye protection including face shields and specially tinted glass. Grinding operations may also require face shields.

Other Protective Clothing or Equipment: As required for the work done on or with the metal.

Work/Hygiene Practices: As required for the work done with lead bearing materials. Meet requirements of the OSHA lead standard where necessary. Always evaluate the jobs done on this product in accordance with OSHA or relevant state, federal, or local standards.

IMPORTANT

LIABILITY DISCLAIMER

The information contained in this Material Safety Data Sheet (MSDS) is believed to be correct as it was obtained from sources we believe are reliable. However, no representations, guarantees or warranties of any kind are made as to its accuracy, suitability for particular applications, hazards connected with the use of the material, or the results to be obtained from the use thereof. User assumes all risks and liability of any use, processing or handling of any material, variations in methods, conditions and equipment used to store, handle, or process the material and hazards connected with the use of the material are solely the responsibility of the user and remain at his sole discretion.

Compliance with all applicable federal, state, and local laws and regulations remains the responsibility of the user, and the user has the responsibility to provide a safe work place to examine all aspects of its operation and to determine if or where precautions, in addition to those described herein, are required.