



Tennessee Aluminum Processors

SAFETY DATA SHEET

1. IDENTIFICATION

PRODUCT NAME: REMELT SECONDARY INGOT (RSI)

SYNONYMS: Remelt Ingot, Remelt Sow, Remelt Scrap Ingot

RECOMMENDED USE: Recycled into aluminum ingot or castings

MANUFACTURER: Tennessee Aluminum Processors, Inc.
7207 Hoover Mason Road
Mount Pleasant, Tennessee 38472
(931) 379-5836

EMERGENCY: For Chemical Emergencies (spill, leaks, fire exposure, accident)
Call CHEMTREC at 800-424-9300 or 703-527-3887

2. HAZARDS IDENTIFICATION

OSHA Hazard Classification: Not Classified As Shipped

Signal Word: None

Hazard Statement(s): None

Symbol(s): None

Precautionary Statement(s): None

Other Considerations:

Aluminum and aluminum alloys are not hazardous in the solid form as shipped. However, certain processes such as cutting, milling, grinding, melting and welding could result in certain hazards. The hazards created by these processes should be fully evaluated by the processing company prior to use. Hazard information on the ingredients and compounds formed from processing is listed in Section 11 for reference.

3. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS#	CONCENTRATION (%)
Aluminum	7429-90-5	70-100
Silicon	7440-21-3	0-23
Copper	7440-50-8	0-11
Magnesium	7439-95-4	0-11
Zinc	7440-66-6	0-11
Tin	7440-31-5	0-7

Bismuth	7440-69-9	0-5
Nickel	7440-02-0	0-5
Iron	7439-89-6	0-2
Manganese	7439-96-5	0-2
Cerium	7440-45-1	0-2
Vanadium	7440-62-2	0-2
Chromium	7440-47-3	0-1
Cobalt	7440-48-4	0-0.5
Beryllium	7440-41-7	0-0.5

NOTE: Percentages of each constituent will vary with the alloy mix. Unless the alloy mix is known, processor should assume that all potential ingredients are present. Additional compounds which may be formed during processing are listed in Section 11.

4. FIRST AID MEASURES

Inhalation: Dust or fume from processing may irritate the respiratory system, and result in difficulty of breathing. If overcome by fumes or dust, remove to fresh air ventilated area. Seek medical attention if irritation occurs or if person has difficulty breathing. If unconscious, check for breathing and presence of pulse. Perform CPR if no pulse or respiration. Get medical attention immediately.

Skin Contact: Irritation may occur from contact with residual oil/lubricant. Wash skin thoroughly with soap and water for at least 15 minutes. If irritation persists, consult a physician.

Eye Contact: Dust or fume from processing may cause irritation. Flush eyes thoroughly with water for at least 15 minutes, taking care to keep the eyelids opened to be sure rinsing is complete. Consult a physician immediately.

Ingestion: Ingestion is an unlikely route of exposure. If ingestion occurs, seek medical attention. Do not induce vomiting unless directed to do so by medical personnel.

5. FIRE-FIGHTING MEASURES

Fire: Not considered a fire hazard as shipped. Non-combustible as shipped.

Explosion: Not considered an explosion hazard as shipped. However, small chips, turnings, dust and fines from processing may be readily ignitable. May be a potential hazard under the following conditions.

- Dust or fines dispersed in the air can be explosive. Even a minor dust cloud can explode violently. Dust accumulation on the floor, ledges and beams can present a risk of ignition, flame propagation and secondary explosions.

- Chips, dust or fines in contact with water can generate flammable/explosive hydrogen gas. Hydrogen gas could present an explosion hazard in confined or poorly ventilated spaces.
- Dust or fines in contact with certain metal oxides (e.g., rust). A thermite reaction, with considerable heat generation, can be initiated by a weak ignition source.
- Molten metal in contact with water/moisture or other metal oxides (e.g., rust, copper oxide). Moisture entrapped by molten metal can be explosive. Contact of molten aluminum with other metal oxides can initiate a thermite reaction. Finely divided metals (e.g., powders or wire) may have enough surface oxide to produce thermite reactions/explosions.

Extinguishing Media: Use coarse water spray on chips and turnings. Use Class D extinguishing agents on dusts, fines or molten metal. Firefighters should wear NIOSH approved self-contained breathing apparatus (SCBA) and full protective clothing where necessary.

DO NOT USE: halogenated agents on small chips, dusts or fines or water around molten metal, these agents will react with the burning material.

Hazardous Combustion Products: At temperatures above the melting point, fumes which contain aluminum oxides and other alloying elements may be liberated. If heated to very high temperatures, copper and zinc fumes may be released.

6. ACCIDENTAL RELEASE MEASURES

General: Does not pose threat as shipped.

If in molten form, contain the flow using dry sand or salt flux as a dam. Do not use shovels or hand tools to halt the flow of molten metal. Allow the spill to cool before re-melting as scrap.

If spilled in dust form, clean up avoiding dust cloud generation. Avoid inhalation of dust.

7. HANDLING AND STORAGE

Handling Precautions: Keep product dry. Avoid generating dust. Avoid contact with sharp edges or heated metal. Hot and cold aluminum are not visually different. Hot aluminum does not necessarily glow red.

Requirements for Processes Which Generate Dusts or Fines:

If processing of these products includes operations where dust or extremely fine particulate is generated, obtain and follow the safety procedures and equipment guides contained in Aluminum Association Bulletin F-i and National Fire Protection Association (NFPA) brochures listed in Section 16. Cover and reseal partially empty containers. Use non-sparking handling equipment. Provide grounding and bonding where necessary to prevent accumulation of static charges during dust handling and transfer operations.

Local ventilation and vacuum systems must be designed to handle explosive dusts. Dry vacuums and electrostatic precipitators must not be used. Dust collection systems must be dedicated to aluminum dust only and should be clearly labeled as such. Do not co-mingle fines of aluminum with fines of iron, iron oxide (rust) or other metal oxides. Do not allow chips, fines or dust to contact water, particularly in enclosed areas. Avoid all ignition sources. Good housekeeping practices must be maintained. Do not use compressed air to remove settled material from floors, beams or equipment.

Requirements for Remelting of Scrap Material and/or Ingot:

Molten metal and water can be an explosive combination. The risk is greatest when there is sufficient molten metal to entrap or seal off the water. Water and other forms of contamination on or contained in scrap or remelt ingot are known to have caused explosions in melting operations. While the products may have minimal surface roughness and internal voids, there remains the possibility of moisture contamination or entrapment. If confined, even a few drops of water can lead to violent explosions.

All tooling and containers which come in contact with molten metal must be preheated or specially coated and rust free. Molds and ladles must be preheated or oiled prior to casting. Any surfaces that may contact molten metal (e.g., concrete) should be specially coated.

Drops of molten metal in water (e.g. from plasma arc cutting), while not normally an explosion hazard, can generate enough flammable hydrogen gas to present an explosion hazard. Vigorous circulation of the water and removal of the particles minimize the hazards.

During melting operations, the following minimum guidelines should be observed:

- * Inspect all materials prior to furnace charging and completely remove surface contamination such as water, ice, snow, deposits of grease and oil or other surface contamination resulting from weather exposure, shipment, or storage.
- * Store materials in dry, heated areas with any cracks or cavities pointed downwards.
- * Preheat and dry large or heavy items such as ingot adequately before charging into a furnace containing molten metal. This is typically done by use of a drying oven or homogenizing furnace. The drying cycle should bring the internal metal temperature of the coldest item of the batch to 400°F and then hold at that temperature for 6 hours.

Storage Conditions: Keep dry and sheltered from precipitation at any time (storage, handling, transportation). Store away from water, strong acids, alkalis and oxidizers.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls: If dust or fumes are generated through processing, use with adequate explosion-proof ventilation to meet the exposure limits listed below.

Respiratory Protection: If dust or fumes are generated through processing, use NIOSH-approved respiratory protection as specified by an Industrial Hygienist or other qualified professional if concentrations exceed the exposure limits listed below.

Note: Air purifying respirators do not protect workers from oxygen-deficient atmospheres.

Skin Protection: Wear appropriate protective clothing to avoid contact. Wear impervious gloves to avoid repeated or prolonged skin contact with residual oils and to avoid skin injury. Wash hands and other exposed areas with mild soap and water prior to eating, drinking or smoking.

Eye Protection: Wear safety glasses with side shields to avoid eye injury while processing. Material poses not eye exposure threat as shipped.

<u>EXPOSURE LIMITS:</u>	- ACGIH (TLV) -		- OSHA (PEL) -	
	TWA	STEL	TWA	Ceiling
Aluminum (Total Dust)	None	None	15 mg/m ³	None
(Respirable Dust)	None	None	5 mg/m ³	None
Silicon (Total Dust)	10 mg/m ³	None	15 mg/m ³	None
(Respirable Dust)	None	None	5 mg/m ³	None
Copper (Fume)	0.2 mg/m ³	None	0.1 mg/m ³	None
(Dust)	1 mg/m ³	None	1 mg/m ³	None
Magnesium	None	None	None	None
Zinc	None	None	None	None
Tin	2 mg/m ³	None	2 mg/m ³	None
Bismuth	None	None	None	None
Nickel	1.5 mg/m ³	None	1 mg/m ³	None
Iron	None	None	None	None
Manganese	0.2 mg/m ³	None	None	5 mg/m ³
Cerium	None	None	None	None
Vanadium (fume as V ₂ O ₅)	0.05 mg/m ³	None	None	0.1 mg/m ³
Chromium	0.5 mg/m ³	None	1 mg/m ³	None
Cobalt	0.02 mg/m ³	None	0.1 mg/m ³	None
Beryllium	0.05 µg/m ³	None	2 µg/m ³	5 µg/m ³

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Silvery solid

Odor: None

Odor Threshold: Not applicable

pH: Not applicable

Melting Point: 482-649 °C (900-1200 °F)

Boiling Point: Not available

Flashpoint: Not applicable

Evaporation Rate: Not applicable

Flammability – Not flammable

Lower Flammable Limit: Not applicable

Higher Flammable Limit: Not applicable

Vapor Pressure: Not applicable

Vapor Density (air=1): Not applicable

Relative Density (water=1): 2.7 (approximately)
Solubility(ies): Not soluble in water
Partition Coefficient (n-octanol/water): Not determined
Auto-ignition Temperature: Not determined
Decomposition Temperature: Not determined
Viscosity: Not applicable

10. STABILITY AND REACTIVITY

Reactivity: May react with acids, bases, and oxidizers. Molten metal may react violently with water or moisture.

Chemical Stability: Stable under normal conditions of use, storage, and transportation as shipped.

Conditions to Avoid:

Chips, fines, dust and molten metal are considerably more reactive with the following:

Water: Slowly generates flammable/explosive hydrogen gas and heat. Generation rate is greatly increased with smaller particles (e.g., fines and dusts). Molten metal can react violently/explosively with water or moisture, particularly when the water is entrapped.

Heat: Oxidizes at a rate dependent upon temperature and particle size.

Strong oxidizers: Violent reaction with considerable heat generation. Can react explosively with nitrates (e.g., ammonium nitrate and fertilizers containing nitrate) particularly when heated or molten.

Acids and alkalis: Reacts to generate flammable/explosive hydrogen gas. Generation rate is greatly increased with smaller particles (e.g., fines and dusts).

Halogenated compounds: Many halogenated hydrocarbons, including halogenated fire extinguishing agents, can react violently with finely divided aluminum.

Iron oxide (rust) and other metal oxides (e.g., copper and lead oxides): A violent thermite reaction generating considerable heat can occur. Reaction with aluminum fines and dusts requires only very weak ignition sources for initiation. Molten aluminum can react violently with iron oxide without external ignition source.

Iron powder and water: An explosive reaction forming hydrogen gas occurs when heated above 1470°F (800°C).

Thermite explosions have been reported when aluminum alloys were melted in furnaces used for alloying with lead, bismuth or other metals with low melting temperatures. These metals, when added as high purity ingots, can seep through cracks in furnace liners and become oxidized. During subsequent melts in the furnace, molten aluminum can contact these metal oxides resulting in a thermite explosion.

Incompatible Materials: Water, strong acids, alkalis and oxidizers.

Hazardous Decomposition Products: Toxic metal oxides, COx and NOx can be produced if involved in a fire.

11. TOXICOLOGICAL INFORMATION

Routes of Exposure: Inhalation: Unlikely
(as shipped) Ingestion: Unlikely
Eye Contact: Unlikely

Skin Contact: Yes
Skin Absorption: No

Acute toxicity: No data available for product
Skin corrosion/irritation: No data available for product
Serious eye damage/eye irritation: No data available for product
Respiratory or skin sensitization: No data available for product
Germ cell mutagenicity: No data available for product
Carcinogenicity: No data available for product
Reproductive toxicity: No data available for product
Specific target organ toxicity –single exposure: No data available for product
Specific target organ toxicity – repeated exposure: No data available for product
Aspiration hazard: No data available for product

Health Effects Associated with Individual Ingredients

Beryllium Can cause lung sensitization in susceptible individuals. Skin contact: Can cause irritant dermatitis, allergic contact dermatitis and lumps on the skin (granulomas). Acute overexposures: Can cause inflammation of the lung tissues (Acute Beryllium Disease). Acute Beryllium Disease can be fatal but is unlikely to occur when processing beryllium-containing aluminum alloys.

Chronic exposures: Chronic inhalation of dust and fumes by sensitized individuals can result in a serious, progressive disease called Chronic Beryllium Disease (CBD). This disease is an allergic condition in which the lung tissues become inflamed. This inflammation, sometimes accompanied with scarring of the lungs (pulmonary fibrosis), restricts the uptake of oxygen into the blood stream. CBD can, overtime, be fatal.

Beryllium studies with experimental animals by inhalation have found lung tumors. IARC/NTP: Listed as known to be a human carcinogen by the NTP. Listed as carcinogenic to humans by IARC (Group 1)*.

Nickel dust and fumes Can cause irritation of eyes, skin and respiratory tract. Eye contact: Can cause inflammation of the eyes and eyelids (conjunctivitis). Skin contact: Can cause sensitization and allergic contact dermatitis. Chronic overexposures: Can cause perforation of the nasal septum, inflammation of the nasal passages (sinusitis), respiratory sensitization, asthma and scarring of the lungs (pulmonary fibrosis). **Nickel alloys** IARC/NTP: Reviewed but not recommended for listing by the NTP. Listed as possibly carcinogenic to humans by IARC (Group 2B)*.

Chromium dust and mist Can cause irritation of eyes, skin and respiratory tract.

Chromium and trivalent chromium IARC/NTP: Not classified by IARC.

Copper dust and mists Can cause irritation of eyes, mucous membranes, skin and respiratory tract. Chronic overexposures: Can cause reduction in the number of red blood cells (anemia),

skin abnormalities (pigmentation changes) and hair discoloration.

Manganese dust or fumes Chronic overexposures: Can cause inflammation of the lung tissue, scarring of the lungs (pulmonary fibrosis), central nervous system damage, secondary Parkinson's disease and reproductive harm in males.

Tin (dust and fume) Chronic overexposures: Can cause benign lung disease (stannosis).

Silicon, inert dusts Chronic overexposures: Can cause chronic bronchitis and narrowing of the airways.

Cerium Can cause irritation of eyes and skin. Chronic overexposures: Can cause lung damage.

Cobalt Can cause irritation of eyes, skin and respiratory tract. Skin contact: Can cause allergic reactions. Acute and chronic overexposures: Can cause respiratory sensitization, asthma, scarring of the lungs (pulmonary fibrosis) and damage to the heart muscle (cardiomyopathy). **Cobalt and certain cobalt compounds** IARC/NTP: Listed as possibly carcinogenic to humans by IARC (Group 2B)*.

Aluminum dust, fines and fumes Low health risk by inhalation. Generally considered to be biologically inert (milling, cutting, grinding). Some products are supplied with a lubricant/oil coating or have residual oil from the manufacturing process. **Oil** Can cause irritation of skin. Skin contact (prolonged or repeated): Can cause dermatitis.

Health Effects Associated with Individual Compounds Formed During Processing
(The following could be expected if welded, remelted or otherwise processed at elevated temperatures.)

Hexavalent chromium (Chrome VI) Can cause irritation of eyes, skin and respiratory tract. Skin contact: Can cause irritant dermatitis, allergic reactions and skin ulcers. Chronic overexposures: Can cause perforation of the nasal septum, respiratory sensitization, asthma, accumulation of fluid in the lungs (pulmonary edema), lung damage, kidney damage, lung cancer, nasal cancer and cancer of the gastrointestinal tract. IARC/NTP: Listed as "known to be a human carcinogen" by the NTP. Listed as carcinogenic to humans by IARC (Group 1)*.

Nickel compounds Associated with lung cancer, cancer of the vocal cords and nasal cancer. IARC/NTP: Listed as "known to be a human carcinogen" by the NTP. Listed as carcinogenic to humans by IARC (Group 1)*.

Magnesium oxide fumes Can cause irritation of eyes and respiratory tract. Acute overexposures: Can cause nausea, fever, chills, shortness of breath and malaise (metal fume fever).

Manganese oxide fumes Can cause irritation of eyes, skin and respiratory tract. Acute overexposures: Can cause nausea, fever, chills, shortness of breath and malaise (metal fume fever).

Copper fume Can cause irritation of eyes, mucous membranes and respiratory tract. Acute overexposures: Can cause nausea, fever, chills, shortness of breath and malaise (metal fume fever).

Zinc oxide fumes Can cause irritation of upper respiratory tract. Acute overexposures: Can cause nausea, fever, chills, shortness of breath and malaise (metal fume fever).

Zinc oxide dust Expected to be a low health risk by inhalation.

Silica, amorphous Acute overexposures: Can cause dryness of eyes, nose and upper respiratory tract.

Iron oxide Chronic overexposures: Can cause benign lung disease (siderosis). Ingestion: Can cause irritation of gastrointestinal tract, bleeding, changes in the pH of the body fluids (metabolic acidosis) and liver damage.

Bismuth compounds Chronic overexposures: Can cause gray-blue discoloration of the mucous membranes, foul breath, skin rash, liver damage and kidney damage.

Tin compounds (dust or fume) Can cause irritation of eyes, skin and respiratory tract.

Vanadium pentoxide Can cause irritation of eyes, skin and respiratory tract. Skin contact (prolonged or repeated): Can cause sensitization and dermatitis. Acute overexposures: Can cause inflammation of the eyes and eyelids (conjunctivitis), bronchitis and the accumulation of fluid in the lungs (pulmonary edema). Effects can be delayed for several days. Chronic overexposures: Can cause kidney damage, blindness, asthma and emphysema. IARC/NTP: Listed as possibly carcinogenic to humans by IARC (Group 2B)*.

Cerium compounds Studies with experimental animals by ingestion have found acute toxicity.

Cerium oxide Can cause irritation of eyes and skin. Additional information: Studies with experimental animals (rats, 50 mg.) by inhalation have not found lung damage.

Alumina (aluminum oxide) Low health risk by inhalation. Generally considered to be biologically inert. If the product is heated well above ambient temperatures or machined, oil vapor or mist may be generated. **Oil vapor and mist** Can cause irritation of respiratory tract. Acute overexposures: Can cause bronchitis, headache, central nervous system effects (nausea, dizziness and loss of coordination) and drowsiness (narcosis).

Acute Toxicity of Ingredients/Formed Compounds

General Product Information: No information available for product.

Component Analysis - LD50/LC50

Silicon: Oral LD50 Rat: 3160 mg/kg

Magnesium: Oral LD50 Rat: 230 mg/kg

Bismuth: Oral LD50 Rat: 5 g/kg

Nickel: Oral LD50 Rat: >9000 mg/kg

Iron: Oral LD50 Rat: 984 mg/kg

Manganese: Oral LD50 Rat: 9 g/kg

Cobalt: Inhalation LC50 Rat: >10 mg/L/1H; Oral LD50 Rat: 6170 mg/kg

Formed Compound Toxicity - LD50s/LC50s

Alumina (non-fibrous): Oral LD50 Rat: >5000 mg/kg

Zinc oxide: Oral LD50 Rat: >5000 mg/kg

Iron oxide: Oral LD50 Rat: >10000 mg/kg

Vanadium pentoxide: Inhalation LC50 Rat: 2.21 mg/L/4H; Oral LD50 Rat: 10 mg/kg; Dermal LD50 Rat: >2500 mg/kg

Oil mist, mineral: Oral LD50 Mouse: 22 g/kg

Carcinogenicity of Ingredients

Ingredient Carcinogenicity – IARC/NTP

Component	CAS	IARC I	IARC 2A	IARC 2B	IARC 3	IARC 4	NTP K	NTP RA
Nickel	7440-02-0	No	No	Yes	No	No	No	No
Chromium	7440-47-3	No	No	No	Yes	No	No	No
Cobalt	7440-48-4	No	No	Yes	No	No	No	No
Beryllium	7440-41-7	Yes	No	No	No	No	Yes	No

Ingredient Carcinogenicity - ACGIH

Nickel A5 - Not Suspected as a Human Carcinogen

Chromium A4 - Not Classifiable as a Human Carcinogen

Cobalt A3 - Confirmed animal carcinogen with unknown relevance to humans

Beryllium A1 - Confirmed Human Carcinogen

Ingredient References

Nickel IARC Monograph 49 [1990], Supplement 7 [1987]

Chromium IARC Monograph 49 [1990] (listed under Chromium and Chromium compounds) Supplement 7 [1987]

Cobalt IARC Monograph 86 [2006] (without tungsten carbide), Monograph 52 [1991]

Beryllium IARC Monograph 58 [1993], Supplement 7 [1987]

Carcinogenicity of Compounds Formed During Processing

Formed Compound Carcinogenicity - IARC/NTP

Component	CAS	IARC I	IARC 2A	IARC 2B	IARC 3	IARC 4	NTP K	NTP RA
Silica fume (amorphous)	69012-64-2	No	No	No	Yes	No	No	No

Nickel compounds	Not Available	Yes	No	No	No	No	Yes	No
Iron oxide	1309-37-1	No	No	No	Yes	No	No	No
Vanadium pentoxide	1314-62-1	No	No	Yes	No	No	No	No
Chromium (III) compounds (as Cr)	Not Available	No	No	No	Yes	No	No	No
Chromium (VI) compounds (certain water insoluble forms)	Not Available	Yes	No	No	No	No	Yes	No
Chromium (VI)	18540-29-9	Yes	No	No	No	No	No	No
Oil mist, mineral	8012-95-1	No	No	No	Yes	No	No	No
Beryllium compounds, n.o.s.	Not Available	Yes	No	No	No	No	Yes	No

Formed Compound Carcinogenicity - ACGIH

Alumina (non-fibrous) A4 - Not Classifiable as a Human Carcinogen

Magnesium oxide A4 - Not Classifiable as a Human Carcinogen

Nickel insoluble compounds (as Nickel) A1 - Confirmed Human Carcinogen

Iron oxide A4 - Not Classifiable as a Human Carcinogen (dust and fume)

Vanadium pentoxide A4 - Not Classifiable as a Human Carcinogen (dust and fume)

Chromium (III) compounds (as Cr) A4 - Not Classifiable as a Human Carcinogen

Chromium (VI) compounds- water soluble A1 - Confirmed Human Carcinogen

Chromium (VI) compounds (certain water insoluble forms) A1 - Confirmed Human Carcinogen

Beryllium compounds, n.o.s. A1 - Confirmed Human Carcinogen

Formed Compound References

Silica fume (amorphous) IARC Monograph 68 [1997] (listed under Amorphous silica)

Nickel compounds IARC Monograph 49 [1990] (evaluated as a group)

Iron oxide IARC Supplement 7 [1987], Monograph 1 [1972]

Vanadium pentoxide IARC Monograph 86 [2006]

Chromium (III) compounds (as Cr) IARC Monograph 49 [1990] (listed under Chromium and Chromium compounds) Supplement 7 [1987]

Chromium (VI) compounds (certain water insoluble forms) IARC Monograph 49 [1990] (evaluated as a group)

Chromium (VI) IARC Monograph 49 [1990] (evaluated as a group)

Oil mist, mineral IARC Supplement 7 [1987], Monograph 33 [1984]

Beryllium compounds, n.o.s. IARC Monograph 58 [1993] (evaluated as a group), Supplement 7 [1987] (evaluated as a group)

Descriptions of IARC and NTP Classifications

IARC 1: The agent is carcinogenic to humans. There is sufficient evidence that a causal relationship existed between exposure to the agent and human cancer.

IARC 2A: The agent is probably carcinogenic to humans. Generally includes agents for which there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals.

IARC 2B: The agent is possibly carcinogenic to humans. Generally includes agents for which there is limited evidence in humans and less than sufficient evidence in experimental animals.

IARC 3: The agent is not classifiable as to its carcinogenicity to humans. Generally includes agents for which there is inadequate evidence in humans and inadequate or limited evidence in experimental animals.

IARC 4: The agent is probably not carcinogenic to humans. Generally includes agents for which there is evidence suggesting lack of carcinogenicity in humans and in experimental animals.

NTP K: Known to be a human carcinogen.

NTP RA: Reasonably anticipated to be a human carcinogen.

12. ECOLOGICAL INFORMATION

No data is available for the product in the solid state as shipped. However, individual components of the product have been found to be toxic to the environment. Metal dusts may migrate into soil and groundwater and be ingested by wildlife.

Component Ecotoxicity - Aquatic Toxicity

Copper (7440-50-8)

- 96 Hr LC50 Pimephales promelas: 23 pg/L
- 96 Hr LC50 Oncorhynchus mykiss: 13.8 pg/L
- 96 Hr LC50 Lepomis macrochirus: 236 pg/L
- 72 Hr EC50 Scenedesmus subspicatus: 120 pg/L
- 96 Hr EC50 water flea: 10 pg/L
- 96 Hr EC50 water flea: 200 pg/L

Zinc (7440-66-6)

- 96 Hr LC50 Pimephales promelas: 6.4 mg/L
- 96 Hr EC50 Selenastrum capricornutum: 30 pg/L
- 72 Hr EC50 water flea: 5 pg/L

Nickel (7440-02-0)

- 96 Hr LC50 Oncorhynchus mykiss: 31.7 mg/L (adult)
- 96 Hr LC50 Pimephales promelas: 3.1 mg/L
- 96 Hr LC50 Brachydanio rerio: >100 mg/L
- 72 Hr EC50 freshwater algae (4 species): 0.1 mg/L
- 72 Hr EC50 Selenastrum capricornutum: 0.18 mg/L
- 96 Hr EC50 water flea: 510 pg/L

Iron (7439-89-6)

- 96 Hr LC50 Morone saxatilis: 13.6 mg/L [static]

Cobalt (7440-48-4)

- 96 Hr LC50 Brachydanio rerio: >100 mg/L [static]

13. DISPOSAL CONSIDERATIONS

Reuse or recycle material wherever possible. Dispose of waste in accordance with federal, state or local regulations. If material is disposed as waste, proper characterization and management of material under RCRA per 40 CFR, Part 261 or equivalent state program/regulation is required. TCLP testing is recommended for chromium. Additional disposal requirements may apply for product components depending on use of product.

14. TRANSPORT INFORMATION

UN Number: Not Applicable
UN Proper Shipping Name: Not Applicable
Hazard Class: Not Applicable
Special Transport Precautions: Keep dry at all times.

15. REGULATORY INFORMATION

US Federal Regulations

A: General Product Information

In reference to Title VI of the Clean Air Act of 1990, this material does not contain nor was it manufactured using ozone-depleting chemicals.

All electrical equipment must be suitable for use in hazardous atmospheres involving aluminum powder in accordance with 29 CFR 1910.307. The National Electrical Code, NFPA 70, contains guidelines for determining the type and design of equipment and installation that will meet this requirement.

B: Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Aluminum (7429-90-5)

SARA 313: 1.0 % de minimis concentration (dust or fume only)

Copper (7440-50-8)

SARA 313: 1.0% de minimis concentration

CERCLA: 5000 lb final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is equal to or exceeds 0.004 inches); 2270 kg final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is equal to or exceeds 0.004 inches)

Zinc (7440-66-6)

SARA 313: 1.0 % de minimis concentration (dust or fume only)

CERCLA: 1000 lb final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is equal to or exceeds 0.004 inches); 454 kg final RQ (no reporting of releases of this hazardous substance is required if the diameter of the solid metal released is equal to or exceeds 0.004 inches)

Nickel (7440-02-0)

SARA 313: 0.1 % de minimis concentration

CERCLA: 100 lb final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is equal to or exceeds 0.004 inches); 45.4 kg final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is equal to or exceeds 0.004 inches)

Chromium (7440-47-3)

CERCLA: 5000 lb final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is equal to or exceeds 0.004 inches); 2270 kg final RQ (no reporting of releases of this hazardous material is required if the diameter of the pieces of the solid metal released is equal to or exceeds 0.004 inches)

Cobalt (7440-48-4)

SARA 313: 0.1 % de minimis concentration

Beryllium (7440-41-7)

SARA 313: 0.1 % de minimis concentration

CERCLA: 10 lb final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is equal to or exceeds 0.004 inches); 4.54 kg final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is equal to or exceeds 0.004 inches)

SARA 311/312 Physical and Health Hazard Categories:

Immediate (acute) Health Hazard: Yes, if particulates/fumes generated during processing.

Delayed (chronic) Health Hazard: Yes, if particulates/fumes generated during processing.

Fire Hazard: No

Sudden Release of Pressure: No

Reactive: Yes, when molten

State Regulations

A: General Product Information

PENNSYLVANIA “Special Hazardous Substance”: Beryllium, Chromium, Mineral oils, Nickel and Nickel oxide.

Chemical(s) known to the State of California to cause cancer: Beryllium and beryllium

compounds, Chromium (hexavalent compounds), Cobalt, Nickel (metallic) and nickel compounds and Vanadium pentoxide.

B: Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS #	CA	FL	MA	MN	NJ	PA
Aluminum	7429-90-5	Yes	No	Yes	Yes	Yes	Yes
Silicon	7440-21-3	No	No	Yes	Yes	Yes	Yes
Copper	7440-50-8	Yes	No	Yes	Yes	Yes	Yes
Magnesium	7439-95-4	Yes	No	Yes	No	Yes	Yes
Zinc	7440-66-6	Yes	No	Yes	No	Yes	Yes
Tin	7440-31-5	Yes	No	Yes	Yes	Yes	Yes
Nickel	7440-02-0	Yes	No	Yes	Yes	Yes	Yes
Iron	7439-89-6	Yes	No	No	No	No	No
Manganese	7439-96-5	Yes	No	Yes	Yes	Yes	Yes
Cerium	7440-45-1	No	No	No	No	Yes	No
Vanadium	7440-62-2	Yes	No	Yes	No	Yes	Yes
Chromium	7440-47-3	Yes	No	Yes	Yes	Yes	Yes
Cobalt	7440-48-4	Yes	No	Yes	Yes	Yes	Yes
Beryllium	7440-41-7	Yes	No	Yes	Yes	Yes	Yes

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

Other Regulations

A: General Product Information

Material meets the criteria for inclusion in WHMIS: Class D2A.

B: Component Analysis - WHMIS IDL

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

Component	CAS #	Minimum Concentration
Aluminum	7429-90-5	1 %
Copper	7440-50-8	1 %
Tin	7440-31-5	1 %
Nickel	7440-02-0	0.1 %
Chromium	7440-47-3	0.1 %
Cobalt	7440-48-4	0.1 %
Beryllium	7440-41-7	0.1 %

C: Component Analysis Inventory

Component	CAS #	CA	FL	MA	MN	NJ	PA
Aluminum	7429-90-5	Yes	No	Yes	Yes	Yes	Yes
Silicon	7440-21-3	No	No	Yes	Yes	Yes	Yes
Copper	7440-50-8	Yes	No	Yes	Yes	Yes	Yes
Magnesium	7439-95-4	Yes	No	Yes	No	Yes	Yes
Zinc	7440-66-6	Yes	No	Yes	No	Yes	Yes
Tin	7440-31-5	Yes	No	Yes	Yes	Yes	Yes
Nickel	7440-02-0	Yes	No	Yes	Yes	Yes	Yes
Iron	7439-89-6	Yes	No	No	No	No	No
Manganese	7439-96-5	Yes	No	Yes	Yes	Yes	Yes
Cerium	7440-45-1	No	No	No	No	Yes	No
Vanadium	7440-62-2	Yes	No	Yes	No	Yes	Yes
Chromium	7440-47-3	Yes	No	Yes	Yes	Yes	Yes
Cobalt	7440-48-4	Yes	No	Yes	Yes	Yes	Yes

Beryllium	7440-41-7	Yes	No	Yes	Yes	Yes	Yes
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Inventory information:

MITI Inventory: Pure metals are not specifically listed by CAS or MITI number on the MITI Inventory. However, the class of compound for each of these metals is listed.

16. OTHER INFORMATION

Reference Documents:

Aluminum Association's Bulletin F-i, "Guidelines for Handling Aluminum Fines Generated During Various Aluminum Fabricating Operations." The Aluminum Association, 1525 Wilson Boulevard, Suite 600, Arlington, Virginia 22209, www.aluminum.org.

Aluminum Association, "Guidelines for Handling Molten Aluminum, The Aluminum Association, 1525 Wilson Boulevard, Suite 600, Arlington, Virginia 22209, www.aluminum.org

NFPA 65, Standard for Processing and Finishing of Aluminum (NFPA phone: 800-344-3555)

NFPA 651, Standard for Manufacture of Aluminum and Magnesium Powder

NFPA 70, Standard for National Electrical Code (Electrical Equipment, Grounding and Bonding)

NFPA 77, Standard for Static Electricity

Guide to Occupational Exposure Values-2006, Compiled by the American Conference of Governmental Industrial Hygienists (ACGIH)

Documentation of the Threshold Limit Values and Biological Exposure Indices, Sixth Edition, 1991, Compiled by the American Conference of Governmental Industrial Hygienists, Inc. (ACGIH)

NIOSH Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services, February 2004

Patty's Industrial Hygiene and Toxicology: Volume II: Toxicology, 4th ed., 1994, Patty, F. A.; edited by Clayton, G. D. and Clayton, F. E.: New York: John Wiley & Sons, Inc.

expub, www.expub.com, Expert Publishing, LLC.

Abbreviations:

CAS# = Chemical Abstracts Service Registry Number

OSHA = Occupational Safety and Health Administration

ACGIH = American Conference of Governmental Industrial Hygienist

PEL = Permissible Exposure Limit

TLV = Threshold Limit Value

TWA = Time-Weighted Average

NTP = National Toxicology Program

IARC = International Agency for Research on Cancer

WHMIS = Working Hazardous Material Information System.

LC50 = Lethal Concentration (50 percent kill)

EC50 = Effective Concentration

CFR = Code of Federal Regulations
RCRA = Resource Conservation and Recovery Act
TCLP = Toxic Characteristic Leaching Procedure, Method 1311
NFPA = National Fire Protection Association
SARA = Superfund Amendments and Reauthorization Act
CERCLA = Comprehensive Environmental Response, Compensation and Liability Act
RQ = Reportable Quantity
MITI = Ministry of International Trade & Industry

Revision Information:

SDS Section(s) changed since last revision of document include: Updated SDS format and classification to comply with OSHA Hazard Communication Standard 2012
MSDS Origin Date: 01/18/1991
SDS Revision Date: 08/29/2008
SDS Revision Date: 05/27/2016

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