

LOW ALPHA & ULTRA LOW ALPHA TIN ANODES SAFETY DATA SHEET

SECTION 1. IDENTIFICATION

Product Identity: Low Alpha & Ultra Low Alpha Tin Anodes

Trade Names and Synonyms: None.

Manufacturer:

Teck Advanced Materials Inc.
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Emergency Telephone: (858) 391-2935

Supplier:

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Product Use: Used in the form of discs, pellets or customized anode shapes for electroplating of low alpha particle emitting tin in the manufacture of microelectronic components.

SECTION 2. HAZARDS IDENTIFICATION

CLASSIFICATION:

NOTE: In the form in which it is sold, this product is not regulated as a Hazardous Product in the U.S. or Canada. This Safety Data Sheet is provided for information purposes only.

Health	Physical	Environmental
Acute Toxicity (Oral, Inhalation) – Does not meet criteria	Does not meet criteria for any Physical Hazard	Aquatic Toxicity – (Short Term/Long Term) does not meet any criteria
Skin Corrosion/Irritation – Does not meet criteria		
Eye Damage/Eye Irritation – Does not meet criteria		
Respiratory or Skin Sensitization – Does not meet criteria		
Mutagenicity – Does not meet criteria		
Carcinogenicity – Does not meet criteria		
Reproductive Toxicity – Does not meet criteria		
Specific Target Organ Toxicity:		
Acute Exposure – Does not meet criteria		
Chronic Exposure – Does not meet criteria		

LABEL:

Symbols: None required	Signal Word: None required
<u>Hazard Statements</u>	<u>Precautionary Statements:</u>
None required	None required

Emergency Overview: A lustrous silvery-white metal that does not burn in bulk but may form explosive mixtures if dispersed in air as a fine powder. Contact with acids or alkalis may generate flammable hydrogen gas. Do NOT use water or foam in fire fighting. Apply dry chemical, sand or special dry powder extinguishing media. Tin is relatively non-toxic and does not pose an immediate hazard to the health of emergency response personnel or to the environment in an emergency situation.

Potential Health Effects: Metallic tin is relatively non-toxic to humans. Chronic inhalation of tin or tin oxides may cause a benign pneumoconiosis called stanosis. This form of pneumoconiosis produces progressive x-ray changes of the lungs as long as exposure exists, but there is no evidence of disability and no special complicating factors. Tin is not listed as a carcinogen by OSHA, NTP, IARC, ACGIH or the EU (see Toxicological Information, Section 11).

Potential Environmental Effects: Since tin is not soluble, it will have minimal direct toxic effects. However, its processing or extended exposure in the environment may result in the formation of compounds that can potentially be toxic to aquatic and terrestrial organisms. Contamination of soil and water should therefore be avoided (see Ecological Information, Section 12).

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

COMPONENTS	CAS Registry No.	CONCENTRATION (% wgt/wgt)
Tin	7440-31-5	>99.99%

Note: See Section 8 for Occupational Exposure Guidelines.

SECTION 4. FIRST AID MEASURES

Eye Contact: *Symptoms:* Mild eye irritation, redness. Do not allow victim to rub eye(s). Let the eye(s) water naturally for a few minutes. If particle/dust does not dislodge, flush with lukewarm, gently flowing water for 5 minutes or until particle/dust is removed, while holding eyelid(s) open. If irritation persists, obtain medical attention. DO NOT attempt to manually remove anything stuck to the eye.

Skin Contact: *Symptoms:* Soiling of skin. *Dust:* No health effects expected. If irritation does occur, wash with lukewarm, gently flowing water and mild soap for 5 minutes or until the product is removed. If skin irritation persists or if you feel unwell, obtain medical advice. *Molten Metal:* Flush contact area to solidify and cool but do not attempt to remove encrusted material or clothing. Cover burns and seek medical attention immediately.

Inhalation: *Symptoms:* Coughing and irritation in heavy dust clouds. If symptoms are experienced remove source of contamination or move victim to fresh air. Get medical advice/attention if you feel unwell or are concerned.

Ingestion: *Symptoms:* Stomach upset, nausea, vomiting. If swallowed, no specific intervention is indicated as this material is not likely to be hazardous by ingestion. However, if irritation or discomfort occurs, obtain medical advice.

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Massive metal is not considered a fire or explosion hazard. However, finely-divided tin metal dust or powder is a moderate fire and explosive hazard when dispersed in the air as a dust cloud at high concentrations and exposed to heat, flame, or other ignition sources. Contact with strong mineral acids and strong alkalis may result in evolution of hydrogen gas which can accumulate to explosive concentrations inside confined spaces.

Extinguishing Media: Use special dry powder extinguishing media (i.e. a Class D extinguisher) or apply dry sand, dolomite, graphite, or powdered sodium chloride. DO NOT use water, carbon dioxide, foam or Halons, especially for fires involving molten metal.

Fire Fighting: If possible, move anodes from fire area and cool containers exposed to flame. Use special powder extinguishing media or apply dry sand, dolomite, graphite or powdered sodium chloride to fires involving molten tin. Do not use direct water streams on fires where molten metal is present. Tin oxide fumes may evolve in intense fires consuming the metal. Fire fighters should be fully trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face piece mask.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Control source of release if possible to do so safely. Clean up spilled material immediately observing precautions in Section 8, Personal Protection. Pick up anodes or anode pieces and return to process where possible. Powder or dust should be cleaned up using methods that will minimize dust generation (e.g., dampen material and wet sweep/shovel, or vacuum solids with a suitable explosion-resistant vacuum). Return uncontaminated spilled material to the process if possible. Place contaminated material in suitable labelled containers for later recovery or disposal. Treat or dispose of waste material in accordance with all local, state/provincial, and national requirements.

Personal Precautions: Long sleeved clothing, gloves, and safety glasses are recommended for persons cleaning up spilled anodes. Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact with dust. Where molten metal is involved, heat-resistant gloves and suitable clothing for protection from hot-metal splash and/or radiant heat should be worn.

Environmental Precautions: Since tin is insoluble and has limited bioavailability, it will have minimal direct ecological risk. However, its processing or extended exposure in the environment may result in the formation of compounds that can potentially be toxic to aquatic and terrestrial organisms. Contamination of water and soil by this product should be prevented.

SECTION 7. HANDLING AND STORAGE

Store anodes in a DRY area, away from incompatible materials such as acids and oxidizers. If anodes are to be remelted they should be THOROUGHLY DRIED before being added to a molten bath. Otherwise, entrained moisture could expand explosively and spatter molten metal out of the bath.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Guidelines:

<u>Component</u>	<u>ACGIH TLV</u>	<u>OSHA PEL</u>	<u>NIOSH REL</u>
Tin	2 mg/m ³	2 mg/m ³	2 mg/m ³

NOTE: OEGs for individual jurisdictions may differ from those given above. Check with local authorities for the applicable OEGs in your jurisdiction.

ACGIH - American Conference of Governmental Industrial Hygienists; OSHA - Occupational Safety and Health Administration; NIOSH - National Institute for Occupational Safety and Health. TLV – Threshold Limit Value, PEL – Permissible Exposure Limit, REL – Recommended Exposure Limit.

NOTE: The selection of the necessary level of engineering controls and personal protective equipment will vary depending upon the conditions of use and the potential for exposure. The following are therefore only general guidelines that may not fit all circumstances. Control measures to consider include:

Ventilation: Use adequate local or general ventilation to maintain the concentration of tin metal dust in the working environment well below recommended occupational exposure limits. Supply sufficient replacement air to make up for air removed by the exhaust system. Where metallic dust particles of tin are being collected and transported by a ventilation system, use of a non-sparking, grounded ventilation system separate from other exhaust ventilation systems is recommended. Locate dust collectors outdoors if possible and provide dust collectors with explosion vents or blow out panels. Refer to appropriate NFPA Standards 484, 654, and/or 68 for specific guidance.

Protective Clothing: Gloves and coveralls, shop coat or other work clothing with long sleeves are recommended to prevent prolonged or repeated direct skin contact when this product is processed. Eye protection should be worn where dust is generated. Where hot or molten metal is handled, heat resistant gloves, goggles or face shield, and clothing to protect from hot metal splash should be worn. Safety type boots are recommended.

Respirators: Where airborne tin dust is generated and cannot be controlled to within acceptable levels by engineering means, use appropriate NIOSH-approved respiratory protection equipment (a 42CFR84 Class N, R or P-95 particulate filter cartridge as a minimum).

General Hygiene Considerations: Refrain from eating, drinking, or smoking in work areas. Thoroughly wash hands after handling and before eating, drinking, or smoking in appropriate designated areas only.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Silvery-white lustrous metal	Odour: None	Odour Threshold: Not Applicable	pH: Not Applicable
Vapour Pressure: Negligible @ 20°C	Vapour Density: Not Applicable	Boiling Point/Range: 2507°C	Melting Point/Range: 232°C
Relative Density (Water = 1): 7.3	Evaporation Rate: Not Applicable	Coefficient of Water/Oil Distribution: Not Applicable	Solubility: Insoluble in water
Flash Point: None	Flammable Limits (LEL/UEL): LEL: 190 g/m ³ /UEL: No Data	Ignition Temperature: 630°C (metallic Sn dust in air).	Decomposition Temperature: Not Applicable

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: Anodes are stable and not considered reactive under normal temperatures and pressures. Hazardous polymerization or runaway reactions will not occur. Metallic tin surfaces slowly oxidize in air, especially in the presence of moisture. Metallic tin may generate hydrogen gas when dissolving in strong mineral acids.

Incompatibilities: Metallic tin is incompatible with strong mineral acids, strong bases and strong oxidizing agents such as the halogen gases, potassium permanganate, and chlorine trifluoride. Powdered tin reacts violently or explosively with fused ammonium nitrate below 200°C as well as with carbon tetrachloride in the presence of water vapour.

Hazardous Decomposition Products: High temperature operations such as oxy-acetylene cutting, electric arc welding or overheating of a molten bath will generate tin oxide fume which, on inhalation in sufficient quantity, can produce metal fume fever, a transient influenza-like illness.

SECTION 11. TOXICOLOGICAL INFORMATION

General: In the metallic form in which this product is sold it is relatively non-toxic. The major route of exposure would be through the generation and inhalation of dust particles of metallic tin.

Acute:

Skin/Eye: Tin is not irritating to the eyes or skin other than by direct abrasive action of metal particles on eye or skin tissue.

Inhalation: Tin overexposure is reported to result in fatigue, depression, low cardiac output (left), low adrenals, shortness of breath, asthma, headaches, and insomnia.

Ingestion: Tin is poorly absorbed in the body but, when ingested in excessive quantities, it can irritate the stomach resulting in nausea and vomiting.

Chronic: Chronic exposure to tin dust may cause a benign pneumoconiosis (Stannosis) characterized by progressive X-ray changes of the lung while exposure continues, but without any distinctive fibrosis or scarring of the lungs and without any evidence of disability. Experimental studies have failed to reveal any evidence of carcinogenicity, mutagenicity, or teratogenicity. Tin is not listed as a carcinogen by the Occupational Safety and Health Administration (OSHA), the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), the American Conference of Governmental Industrial Hygienists (ACGIH) or the European Union (EU).

Animal Toxicity:

<u>Ingredient:</u>	<u>Acute Oral Toxicity:</u>	<u>Acute Dermal Toxicity:</u>	<u>Acute Inhalation Toxicity:</u>
Tin	No data	No data	No data

SECTION 12. ECOLOGICAL INFORMATION

While this product is relatively insoluble, its processing or extended exposure in aquatic and terrestrial environments may lead to the release of tin in bioavailable forms. Compounds of tin have relatively low toxicity; however, there is only limited information on their environmental fate and effects. Water hardness, pH and dissolved organic carbon content are factors which can regulate both the degree of toxicity and the bioaccumulation of dissolved metal. In soil, tin tends to become highly sorbed to soil particles in relation to soil properties. Tin is believed to have the potential to bioaccumulate in plants and animals in aquatic and terrestrial environments.

SECTION 13. DISPOSAL CONSIDERATIONS

If material cannot be returned to process or salvage, dispose of in accordance with applicable regulations.

SECTION 14. TRANSPORT INFORMATION

Proper Shipping Name..... Not regulated.
 Transport Canada and DOT Hazard Classification Not applicable.
 Transport Canada and U.S. DOT Product Identification Number Not applicable.
 Marine Pollutant No.
 IMO Classification Not regulated.

SECTION 15. REGULATORY INFORMATION

U.S.
 Ingredients Listed on TSCA Inventory..... Yes
 Hazardous Under Hazard Communication Standard No
 CERCLA Section 103 Hazardous Substances..... No

EPCRA Section 302 Extremely Hazardous Substance..... No Hazard Categories Apply
EPCRA Section 311/312 Hazard Categories No Hazard Categories Apply
EPCRA Section 313 Toxic Release Inventory: This product does not contain any toxic chemicals subject to the Toxic Release reporting requirements.

SECTION 16. OTHER INFORMATION

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The information in this Safety Data Sheet is based on the following references:

- American Conference of Governmental Industrial Hygienists, 2004, Documentation of the Threshold Limit Values and Biological Exposure Indices, Seventh Edition plus updates.
- American Conference of Governmental Industrial Hygienists, Guide to Occupation Exposure Values - 2015.
- American Conference of Governmental Industrial Hygienists, 2015, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- Bretherick's Handbook of Reactive Chemical Hazards, 20th Anniversary Edition. (P. G. Urben Ed.) 1995.
- Canadian Centre for Occupational Health and Safety (CCOHS) Hamilton, ON, CHEMINFO Record No. 3462 – Tin.
- Commission de la santé et la sécurité du travail, Service du répertoire toxicologique, ETAIN, 20110-07.
- European Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures, amending and repealing directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (REACH).
- Expert Group on Vitamins and Minerals, UK Food Standards Agency, May 2003, pp 240 -245 (<http://www.food.gov.uk/multimedia/pdfs/vtmin2003.pdf>).
- Handbook on the Toxicology of Metals, 3rd Ed., Gunnar F. Nordberg, Bruce A. Fowler, Monica Nordberg and Lars Friberg, Editors, Academic Press, New York, NY (2007).
- Health Canada, SOR/2015-17, Hazardous Products Regulations, 30 January 2015.
- Merck & Co., Inc., 2001, The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Thirteenth Edition.
- National Oceanic and Atmospheric Administration, Office of Response and Restoration, CAMEO Chemicals – Database of Hazardous Materials [<http://www.cameochemicals.noaa.gov/>] *last accessed 23 Jul 2011*.
- Patty's Toxicology, Fifth Edition, 2001: E. Bingham, B. Cohrssen & C.H. Powell, Ed.
- Powder Dust Explosion Review by READE, (<http://www.reade.com/Safety/dust.html>, (*last accessed 24 Jul 2011*)).
- Toxicity of Tin and Its Compounds, K A Winship: Adverse Drug React Acute Poisoning Rev. 7(1), pp 19-38, Spring 1988.
- U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, Registry of Toxic Effects of Chemical Substances (RTECS) online – (*last accessed 18 Jul 2015*).
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.

Notice to Reader

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