Rio Tinto

Lithium Metal

Safe Handling Guide

Disclaimer

In preparing this guide, Rio Tinto has utilized the best information known and available at the time of printing. Rio Tinto recognizes that over time techniques, methods and equipment related to the safe handling of lithium metal will evolve, dating the information within this guide.

Additionally, the information presented in this guide has been written to address most typical situations, environments and facilities, based upon Rio Tinto's experiences. However, Rio Tinto recognizes that each customer's situation is different and necessitates specific solutions to fit those requirements.

Rio Tinto seeks to provide up-to-date solutions to the questions or concerns that our customers may have. Please contact us to discuss your specific needs.

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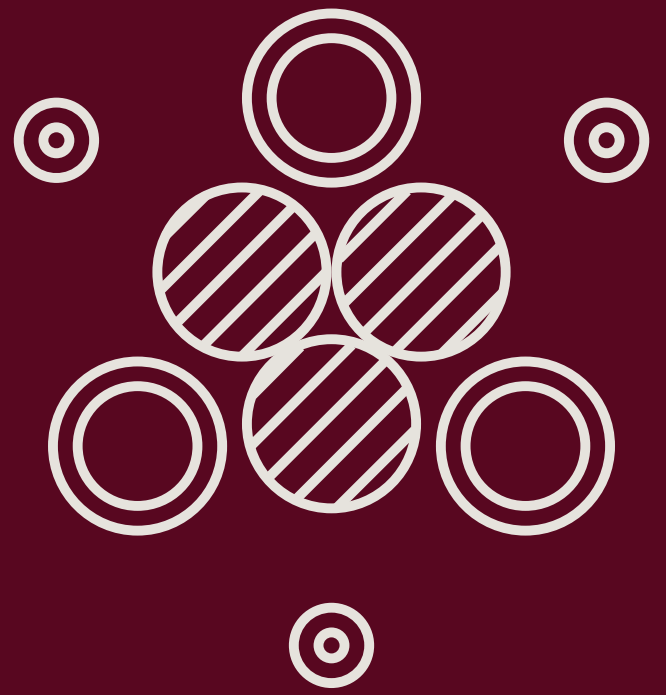


Properties of Lithium Metal

What is Lithium Metal?

A somewhat soft, silver-white metal in elemental form

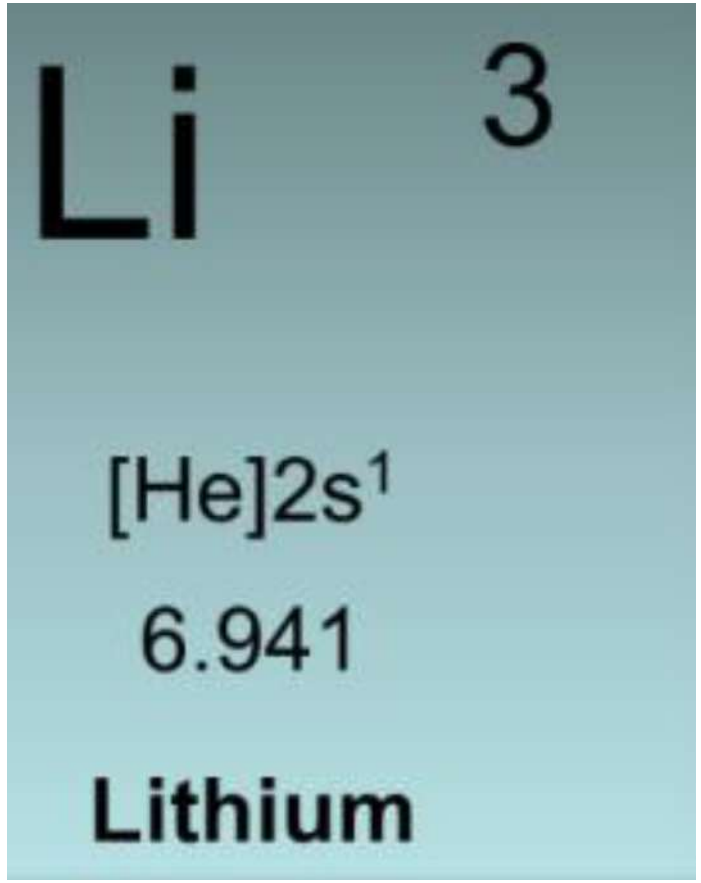
The lightest metal

d=0.534 g/cm³

Has a high electrochemical potential

more negative standard electrode potential relative to standard hydrogen electrode

Flammable and air and water sensitive



Lithium elemental block form periodic table

Properties of Lithium Metal

Handling & Storage

Lithium metal, like other alkali metals, is very reactive toward water and air. The degree of the metal's reactivity is proportional to its surface area. Large pieces of lithium metal will react relatively slowly with air and water while lithium metal as a finely divided powder can react very rapidly.

$$2\,Li + H_2O \rightarrow Li_2O + H_2$$

Lithium will react with nitrogen in the air to form lithium nitride. This reaction is catalyzed by the presence of moisture in the air. Lithium should be stored under argon.

$$6\,Li + N_2 \rightarrow 2\,Li_3N$$

For this reason, lithium metal is usually handled under argon, in oil and/or in a dry room. Even in a dry environment, however, finely divided dry lithium powder will react with the oxygen in the air unless it is protected with an inert coating. These coatings allow even finely divided lithium metal powder to be handled in a dry room environment for extended periods of time.

$$4\,Li + O_2 \rightarrow 2\,Li_2O$$

Lithium Metal Product Offering

Rio Tinto Products

Grades:

- Battery
- Alloy
- Technical

Forms:

- Bulk
- Ingot
- Stabilized Lithium Metal Powder (SLMP®)

See Product Data Sheets or contact Rio Tinto at lithium.customersupport@riotinto.com for more information.

Physical Properties

Appearance	Silvery-white soft metal solid
Molecular Formula	Li
Molecular Weight	6.941
Atomic Number	3
Melting Point	180.5 ºC
Boiling Point	1317 ºC
Autoignition Temperature	179 ºC
Solubility in Water	Reacts violently with water
Density (g/cc)	20 ºC 0.534
	200 ºC 0.507

2.0
Hazards

Hazards: Lithium is highly reactive

- Lithium is highly reactive in contact with many substances, releasing large quantities of heat and/or hazardous products.
- Lithium can react violently with water, even the humidity in the air, and the moisture in other substances, releasing hydrogen gas, which may catch fire explosively.
- Corrosive fumes of lithium oxide and/or lithium hydroxide are also released.
- Lithium is incompatible with acids, oxidizers, oxygen and nitrogen.
- Reactivity of lithium increases with surface area.

Physical hazards

- GHS Classification: Water Reactive, Category 1
- Water and air reactive solid
- Not sensitive to static discharge. Does not polymerize.
- Autoignition temperature 179°C. Essentially melting point.
- Molten lithium is pyrophoric.

Other hazards

Health hazards

- GHS Classification: Skin corrosive category 1B
- Lithium is extremely reactive with body moisture and is corrosive to skin, nose, throat, stomach and eyes (may cause blindness)

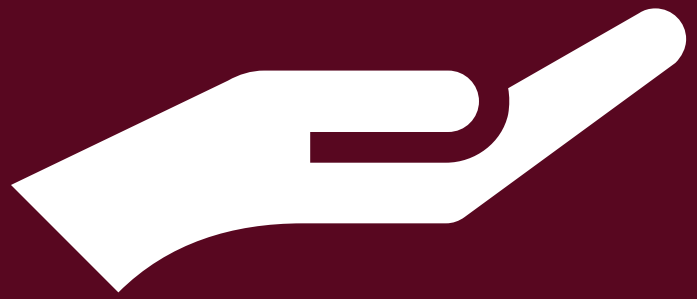
Toxicological information

Corrosive and Water Reactive

Environmental hazards

- Lithium reacts violently with water
- The hydrolysis products consist of hydrogen gas and lithium hydroxide
- The hydroxide ion may affect the pH of the water

3.0
Handling



Handling

Lithium should only be handled by trained personnel wearing proper personal protective equipment.

Solid lithium can be handled in open atmosphere at room temperature, either coated in mineral oil or where relative humidity is maintained below 50%. To maintain best quality, humidity levels of less than 2% are recommended.

Reactivity increases with temperature and surface area, so molten, dispersions, and powders require special handling.

Mineral oil or Argon is recommended for dispersions and powder, while molten lithium can only be handled under Argon.

Personal protective equipment

Eyes and Face

- Safety goggles for solid lithium
- Full flame-resistant face shield required if lithium is in a molten state

Respiratory

- None

Protective Clothing

- Dry rubber gloves for solid lithium.
- Wear full flame-resistant clothing if lithium is in the molten state.

Work Hygienic Practices

- Quick-drench eyewash and safety shower

Storage

- Store lithium in original unopened shipping container in a cool, dry location.
- Once opened either store under argon, in a dry room or under mineral oil.
- Do not use a water fire-suppression system in lithium storage area.
- Keep away from water, humid air, acids and oxidizing materials.
- Keep away from heat, sparks and flame.

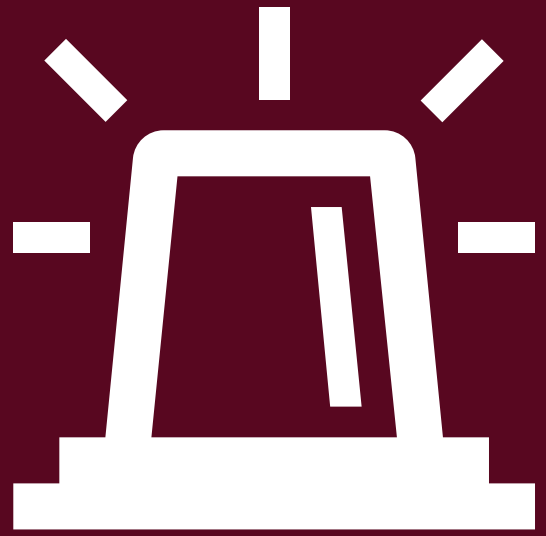
Transportation

Proper Shipping Name	Lithium
Classification	Class 4.3 Dangerous When Wet
UN Number	UN1415
Packing Group	I
Marine Pollutant	No

Waste disposal

- Waste containing lithium metal should only be disposed of by a reputable licensed hazardous waste disposal facility experienced in handling reactive chemicals.
- Strict packaging guidelines exist for shipping lithium metal as a hazardous waste and are available from disposal firms.
- Rio Tinto is not a licensed hazardous waste and treatment facility and cannot accept shipment or returns of material that meet the criteria of a hazardous waste.
- Contact Rio Tinto if you need further information or industry contacts on proper lithium disposal.

4.0
Emergency guidelines



First aid measures

Eyes

Immediately flush with water for a minimum of 15 minutes.

See physician immediately.

Skin

Quickly wipe off as much as possible, then immediately flush with plenty of water.

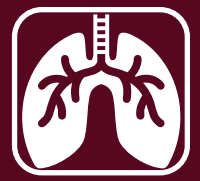
Remove contaminated clothing, wash with soap and water.

Ingestion

Quickly wipe material from mouth and rinse with water.

Do not induce vomiting.

See a physician immediately.



Inhalation

Remove to fresh air.

If breathing difficulty occurs and persists, see a physician.

If breathing has stopped give artificial respiration.

Fire fighting

Wear full protective clothing and self-contained breathing apparatus (SCBA) approved for fire fighting. This is necessary to protect against the hazards of heat, products of combustion and oxygen deficiency. Do not breathe smoke, gases or vapors generated.

Lithium fires can throw off molten lithium metal particles. Burning lithium releases corrosive lithium oxide dust and fumes. Lithium metal can reignite after fire is initially extinguished.

Never leave extinguished fire unattended. After all material has apparently burned and cooled, carefully turn over remaining residue and be prepared to re-extinguish should reaction occur.

Carefully place residue in steel drum, using a long-handled shovel, and cover with extinguishing media.

For additional fire fighting information, see National Fire Protection Association (NFPA) Standard NFPA 484.

More information:

Customersupport@riotinto.com

In case of an emergency call:
CHEMTREC at 1-800-424-9300

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