

Lithium



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IDENTIFICATION

Lithium

ZVG No: 8010
CAS No: 7439-93-2
EC No: 231-102-5
INDEX No: 003-001-00-4

CHARACTERISATION

SUBSTANCE GROUP CODE

134000 Metals

STATE OF AGGREGATION

The substance is solid.

PROPERTIES

Soft, flexible, inflammable metal
white to silvery shining

CHEMICAL CHARACTERISATION

The solid metal ignites when heated above its boiling point.
As powder or dust it is self igniting already at room temperature.
In contact with water releases flammable gases which may ignite spontaneously.
Aqueous solution reacts strongly alkaline.

Acute or chronic health hazards result from the substance.
(see: chapter REGULATIONS).

[Substance information in Wikipedia](#)

FORMULA

Molar mass: 6,94 g/mol

PHYSICAL AND CHEMICAL PROPERTIES

[Melting point](#) | [Boiling point](#) | [Density](#) | [Solubility](#) |
[Hazardous reactions](#)

MELTING POINT

Melting point: 180,54 °C

Reference: [00456](#)

BOILING POINT

Boiling Point: 1342 °C

Reference: [00456](#)

DENSITY

DENSITY

Value: 0,534 g/cm³

Temperature: 25 °C

Reference: [01221](#)

SOLUBILITY IN WATER

decomposition

Reference: [00456](#) [01211](#)

HAZARDOUS REACTIONS

Thermal decomposition

Self-igniting in contact with water or air.

Hazardous chemical reactions

Risk of explosion in contact with:

chlorine
oxygen
water
lower alcohols
bromine (impact)
bromobenzene/metal powders
bromoform (impact)
chloroform
diazomethane
dichloromethane
halogenated hydrocarbons (impact)
iodine (heat, rare)
methyl iodide
carbon monoxide/water
methyl hydroperoxide
mineral acids
sulfur (molten)
sulfur dioxide
conc. sulfuric acid
silver bromide
silver iodide
tetrachloromethane(heat)
thionyl chloride
trichloroethene/pieces
trichlorotrifluoroethane/pieces
water + metal powders
water + molten metals

The substance can react dangerously with:

fluorine
nitric acid
acids
higher alcohols
concrete/burning lithium
boron trifluoride
chlorine trifluoride -> self-ignition
chromium(III)-chloride
chromium trioxide (180 deg. C)
diborane
oxygen difluoride
iron sulfide (180 deg. C)
ethylene (heat)
halogenides
iodine pentafluoride
carbon dioxide (heat)
air (180 deg. C) --> self ignition
air (finely dispersed lithium)
metal oxides (heat)
sodium carbonate (heat)
sodium chloride (heat)
sodium nitrite
phosphorus (heat)
platinum (540 deg. C)
mercury
finely dispersed rust
sulfur bromide
silicates/burning lithium
nitrogen (heat)
hydrogen
tin-alloys with lithium
zirconium(IV) chloride

OCCUPATIONAL HEALTH AND FIRST AID

Toxic effects

TOXIC EFFECTS

Annotation

Up to the day of compilation, the 25.04.2018, the information published in the available literature was insufficient.

SAFE HANDLING

[Handling](#) | [Storage](#) | [Fire and explosion protection](#) | [Organisational measures](#) | [Personal protection](#) | [Disposal considerations](#) | [Accidental release measures](#) | [Fire fighting measures](#)

TECHNICAL MEASURES - HANDLING

Workplace

Provision of good ventilation in the working area.

Washing facility at the workplace required.

Eye bath required. These locations must be signposted clearly.

When handling excessive amounts of the substance an emergency shower is required.

Equipment

Use only closed apparatus.

If release of the substance cannot be prevented, then it should be suctioned off at the point of exit.

Consider emission limit values, a purification of waste gases if necessary.

Label containers and pipelines clearly.

Advice on safer handling

Take care to keep workplace clean and dry.

The substance must not be present at workplaces in quantities above that required for work to be progressed.

Do not leave container open.

Use leak-proof equipment with exhaust for refilling or transfer.

Keep lithium powder or dust under inert gas.

Ensure the substance is kept dry during refilling or transfer.

Avoid spillage.

Use tongs for picking up lithium.

Fill only into labelled container.

Avoid any contact when handling the substance.

Avoid rising dust.

Do not transport together with incompatible substances.

Use an appropriate exterior vessel when transporting in fragile containers.

Cleaning and maintenance

Use protective equipment while cleaning if necessary.

Avoid dust formation. Dust formation that cannot be avoided must be collected regularly.

Use tested industrial vacuum cleaners or suction systems for areas with a high risk of explosion.

Do not raise dust while cleaning.

Use of a blower for cleaning is not permitted.

Do not clean damp.

Only conduct maintenance and other work on or in the vessel or closed spaces after obtaining written permission.

TECHNICAL MEASURES - STORAGE

Storage

Do not use any food containers - risk of mistake.
Containers have to be labelled clearly and permanently.
Store in the original container as much as possible.
Preferably use unbreakable containers rather than glass containers.
Place fragile vessels in break-proof outer vessels.
Keep container tightly closed in a cool, dry and well-ventilated place.
Store apart from sources of ignition and heat.
Store smaller vessels in cabinets with collecting tubs.
Protect from overheating/heating up.
Protect from moisture.
Keep contents under argon.

Conditions of collocated storage

Storage class 4.3 (Substances liberating flammable gases in contact with water)

Only substances of the same storage class should be stored together.

Collocated storage with the following substances is prohibited:

- Pharmaceuticals, foods, and animal feeds including additives.
- Infectious, radioactive und explosive substances.
- Gases.
- Aerosols (spray bottles).
- Flammable liquids of storage class 3.
- Other explosive substances of storage class 4.1A.
- Strongly oxidizing and oxidizing substances of storage classes 5.1A and 5.1B.
- Ammonium nitrate and preparations containing ammonium nitrate.
- Organic peroxides and self reactive substances.
- Combustible and non combustible acutely toxic substances of storage classes 6.1A and 6.1B.

Under certain conditions the collocated storage with the following substances is permitted (For more details see [TRGS 510](#)):

- Flammable solid substances or desensitized substances of storage class 4.1B.
- Pyrophoric substances.
- Combustible toxic or chronically acting substances of storage class 6.1C.
- Noncombustible toxic or chronically acting substances of storage class 6.1D.
- Combustible corrosive substances of storage class 8A.
- Noncombustible corrosive substances of storage class 8B.
- Combustible liquids of storage class 10.
- Combustible solids of storage class 11.
- Noncombustible liquids of storage class 12.

The substance should not be stored with substances with which hazardous chemical reactions are possible.

TECHNICAL MEASURES - FIRE AND EXPLOSION PROTECTION

Technical, constructive measures

Substance is combustible.

Powder or dust is pyrophoric at room temperature.

Fire fighting equipment must be available.

In case of risk of water contact and release of flammable gases in hazardous quantities, explosion protection measures in accordance with [TRGS 722](#) (prevention of formation), [TRGS 723](#) (prevention of ignition) and [TRGS 724](#) (constructive explosion protection) may be required.

Take precautionary measures against static discharges.

Earth all parts which can be electrically charged.

Inspect the electrical fittings regularly against the higher risk of corrosion.

Precaution on handling

Area with fire risk.

Areas in which the substance may have contact with water are to be considered as at risk of explosion.

Keep at a distance from sources of ignition (e.g. electrical devices, open flames, heat sources, sparks).

Observe the smoking prohibition!

Absolutely no welding in the working area.

Only work with vessels and lines after these have been thoroughly rinsed and inerting.

Work done with fire or open flame should only be carried out with written permission if the risk of fire or explosion cannot be completely eliminated.

Do not use any tools that cause sparks.

Handle emptied containers with care. Ignition and explosion are possible on contact with moisture.

ORGANISATIONAL MEASURES

Instruction on the hazards and the protective measures using instruction manual ([TRGS 555](#)) are required with signature if just more than one minor hazard was detected.

Instruction must be provided before employment and then at a minimum of once per annum thereafter.

An escape and rescue plan must be prepared when the location, scale, and use of the work-site so demand.

Observe the restrictions on juvenile employment as defined in the "Jugendarbeitsschutzgesetz".

PERSONAL PROTECTION**Body protection**

Depending on the risk, wear a sufficiently long apron and boots or a suitable chemical protection suit.

Wear flameproof, antistatic protective clothing.

Respiratory protection

In an emergency (e.g.: unintentional release of the substance) respiratory protection must be worn. Consider the maximum period for wear.

Respiratory protection: Particle filter P2, colour code white.

Use insulating device for concentrations above the usage limits for filter devices, for oxygen concentrations below 17% volume, or in circumstances which are unclear.

Eye protection

Sufficient eye protection must be worn.

Wear chemical safety goggles.

If the face is at risk a protective shield must also be worn.

Hand protection

Use protective gloves. The glove material must be sufficiently impermeable and resistant to the substance. Check the tightness before wear. Gloves should be well cleaned before being removed, then stored in a well ventilated location. Pay attention to skin care.

Skin protection cremes do not protect sufficiently against the substance.

Currently there is no information available regarding suitable glove materials.

Experience says that polychloroprene, nitrile rubber, butyl rubber, fluoro-caoutchouc, and polyvinyl chloride are suitable as glove materials for protection against un-dissolved solids.

The lithium may be stored under a protective liquid, in that case the glove material has to be resistant to that substance as well.

Occupational hygiene

Foods, beverages and other articles of consumption must not be consumed at the work areas. Suitable areas are to be designated for these purposes.

Avoid contact with skin. In case of contact wash skin.

Avoid contact with eyes. In case of contact rinse the affected eye(s).

Avoid contact with clothing. Contaminated clothes must be exchanged and cleaned carefully.

Dry removal of lithium pieces if possible.

Provide washrooms with showers and if possible rooms with separate storage for street clothing and work clothing.

The skin must be washed with soap and water before breaks and at the end of work. Apply fatty skin-care products after washing.

DISPOSAL CONSIDERATIONS

Hazardous waste according to Waste Catalogue Ordinance (AVV).

If there is no way of recycling it must be disposed of in compliance with the respective national and local regulations.

Collection of small amounts of substance:

The substance can be presented in an inert solvent and deactivated by adding 2-propanol in drops under stirring. If the reaction proceeds vigorously, the conversion should be carried out with tert-butanol or octanol. Warning: the originated hydrogen can lead to an oxyhydrogen gas explosion; therefore make the appropriate provisions. After the reaction stops add water drop-wise; neutralisation.

Place in a collecting container for salt solutions, adjust for a pH value of 6 - 8.

Do not put/place waste into sink or dust bin.

Collection vessels must be clearly labelled with a systematic description of their contents. Store the vessels in a well-ventilated location. Entrust them to the appropriate authorities for disposal.

ACCIDENTAL RELEASE MEASURES

Shut off all sources of ignition.

Evacuate area. Warn affected surroundings.

The hazardous area may only be entered once suitable protective measures are implemented. Only then can the hazardous situation be removed (see chapter Personal Protection).

Cover spilt lithium with dry limestone dust and collect it with a pincer. Place it in a sealable container filled with oil or mineral fat.

Attention! Substance reacts with water. Avoid contact with water.

Use non-sparking tools.

Afterwards ventilate area and wash spill site.

Endangerment of watert:

Low hazard to waters. Inform the responsible authorities when very large quantities get into water, drainage, sewer, or the ground.

FIRE FIGHTING MEASURES

Classes of fires

D combustible metals

Suitable extinguishing media

Metal fire extinguisher

extinguishing media: sodium chloride, -bicharbonate or calcareous sandstone

Unsuitable extinguishing media

Water

Foam

Carbon dioxide

Instructions

Avoid direct contact of the substance with water.

In contact with water product releases hydrogen

If possible, take container out of dangerous zone.

Shut off sources of ignition.
Use only explosion proved equipment.

Special protective equipment

Wear self-contained breathing apparatus and special tightly sealed suit.

REGULATIONS

[GHS Classification/Labelling](#) | [Workplace labelling](#) | [Water hazard class](#) | [Air quality control](#) | [Transport Regulations](#) | [MAK recommendations](#) | [SevesoIII](#) | [Restriction of use](#) | [Technical rules](#) | [Regulations of accident insurers](#)

EUROPEAN GHS CLASSIFICATION AND LABELLING

Classification

Substances, which in contact with water, emit flammable gases, Category 1; H260
Skin corrosion, Category 1B; H314



Signal Word "Danger"

Hazard Statement - H-phrases

H260: In contact with water releases flammable gases which may ignite spontaneously.
H314: Causes severe skin burns and eye damage.

Supplemental Hazard Statement - EUH-phrases

EUH014: Reacts violently with water.

Precautionary Statement - P-phrases

P223: Do not allow contact with water.
P231+P232: Handle and store contents under inert gas. Protect from moisture.
P260: Do not breathe dust..
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P303+P361+P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water or shower.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Manufacturer's specification by Sigma-Aldrich

Reference: [01221](#)

State: 2023

Checked: 2023

The substance is listed in appendix VI, table 3 of CLP regulation.
The given classification can deviate from the listed classification, since this classification is to be complemented concerning missing or divergent danger classes and categories for the respective substance.

Reference: [99999](#)

GHS-CLASSIFICATION OF MIXTURES

The classification of mixtures containing this substance results from Annex 1 of Regulation (EC) 1272/2008.

Reference: 07500

WORKPLACE LABELLING ACCORDING TO GERMAN ASR A1.3

Prohibition label



No open flame; fire, open ignition sources and smoking prohibited



Do not extinguish with water

Warning label



Caution - inflammable material



Caution - corrosive material

Precept label



Use safety goggles



Wear safety gloves

GERMAN WATER HAZARD CLASS

Substance No: 7195

WGK 1 - low hazard to waters

Classification according to the announcement of the list of substances hazardous to water in the Federal Register of 10.08.2017, last update 24.11.2023

TECHNICAL INSTRUCTIONS ON AIR QUALITY CONTROL (TA LUFT)

Chapter 5.2.1 Overall Dust, including fine dust

The emissions of dust in the exhaust gas are not allowed to exceed the following values:

Mass flow: 0,20 kg/hr

or

Mass conc.: 20 mg/m³

The mass per unit volume of 0,15 g/m³ in exhaust gas is not allowed to be exceeded also on observance or lower deviation of a mass flow of 0,20 kg/h.

TRANSPORT REGULATIONS

UN Number: 1415
Shipping name: Lithium, non-pyrophoric
Hazard Identification Number: X423
Class: 4.3 (Substances which emit flammable gas in contact with water)
Packing Group: I (high danger)
Danger Label: 4.3



Classification code: W2

Tunnel restrictions:

Transports in tanks: passage forbidden through tunnels of category B, C, D and E.
Other transports: passage forbidden through tunnels of category E.

Reference: 07902

RECOMMENDATIONS OF MAK-COMMISSION

This data is recommended by scientific experience and is not established law.

II b) substances, for which (still) no MAK-values can be established

Lithium and more strongly irritant Lithium compounds

DIRECTIVE 2012/18/EU (Seveso III)

The substance is subject to the hazard categories of the Hazardous Incident Ordinance:

01 Substances or mixtures with hazard statement EUH014

Quantity thresholds for determination of operation scopes:

Annex I Part 1 Section: 01
Substances or mixtures with hazard statement EUH014
Qualifying quantity for the application of
Lower-tier requirements: 100 t
Upper-tier requirements: 500 t

RESTRICTIONS OF USE / BANS OF USE

REACH Regulation (EC) No 1907/2006 Annex XVII

Annex XVII, Point 40

Shall not be used, as substance or as mixtures in aerosol dispensers where these aerosol dispensers are intended for supply to the general public for entertainment and decorative purposes such as the following:

- metallic glitter intended mainly for decoration,
- artificial snow and frost,
- “whoopee” cushions,
- silly string aerosols,
- imitation excrement,
- horns for parties,
- decorative flakes and foams,
- artificial cobwebs,
- stink bombs.

Further information on prohibitions and exceptions can be taken from the regulation.

Annex XVII, Point 75

Mixtures containing certain hazardous substances shall no longer be placed on the market for tattooing purposes. Mixtures containing such substances in specified concentrations shall no longer be used for tattooing purposes after 04.01.2022. Substances falling within one or more of the following points:

- carcinogenic or reproductive toxic substances according to Part 3 of Annex VI to CLP Regulation (excluding the classification due to effects only following exposure by inhalation),
- skin-sensitising, skin-corrosive, skin-irritant, serious eye-damaging or eye-irritant substances according to Annex VI Part 3 of the CLP Regulation,
- substances listed with specified conditions in Annex II or IV to Regulation (EC) No 1223/2009 [Cosmetics Regulation], and
- substances listed in Appendix 13 to Annex XVII (point 75) of the REACH Regulation.

In general, mixtures placed on the market for use for tattooing purposes must be labelled "Mixture for use in tattoos or permanent make-up." from 04.01.2022 on and may not be used for tattooing purposes without this labelling. Further safety information shall be provided on the packaging or in the instructions for use. Before using a mixture for tattooing purposes, the person using the mixture shall provide this information to the person undergoing the procedure.

Further information on the restrictions, concentration limits and exemptions can be taken from the Regulation.

Annex XVII to Regulation (EC) No 1907/2006, [consolidated version](#) (BAUA) (only in German)

TECHNICAL RULES FOR HAZARDOUS SUBSTANCES

[TRGS 201](#)

Einstufung und Kennzeichnung bei Tätigkeiten mit Gefahrstoffen; Ausgabe Februar 2017, zuletzt geändert und ergänzt April 2018

[TRGS 400](#)

Gefährdungsbeurteilung für Tätigkeiten mit Gefahrstoffen; Ausgabe Juli 2017

[TRGS 555](#)

Betriebsanweisung und Information der Beschäftigten; Ausgabe Februar 2017

[TRGS 600](#)

Substitution; Ausgabe Juli 2020

[TRGS 401](#)

Gefährdung durch Hautkontakt, Ermittlung - Beurteilung - Maßnahmen; Ausgabe Oktober 2022

[TRGS 500](#)

Schutzmaßnahmen; Ausgabe September 2019

[TRGS 509](#)

Lagern von flüssigen und festen Gefahrstoffen in ortsfesten Behältern sowie Füll- und Entleerstellen für ortsbewegliche Behälter; Ausgabe Juni 2022

[TRGS 510](#)

Lagerung von Gefahrstoffen in ortsbeweglichen Behältern; Ausgabe Januar Dezember 2020

[TRGS 800](#)

Brandschutzmaßnahmen; Ausgabe Dezember 2010

[TRGS 720](#)

Gefährliche explosionsfähige Gemische - Allgemeines; Ausgabe Juli 2020, zuletzt berichtigt März 2021

[TRGS 721](#)

Gefährliche explosionsfähige Gemische - Beurteilung der Explosionsgefährdung; Ausgabe Oktober 2020, zuletzt berichtigt Dezember 2020

[TRGS 722](#)

Vermeidung oder Einschränkung gefährlicher explosionsfähiger Atmosphäre, Ausgabe Februar 2021

[TRGS 723](#)

Gefährliche explosionsfähige Gemische - Vermeidung der Entzündung gefährlicher explosionsfähiger Gemische; Ausgabe Juli 2019, zuletzt geändert Oktober 2020

[TRGS 724](#)

Gefährliche explosionsfähige Gemische - Maßnahmen des konstruktiven Explosionsschutzes, welche die Auswirkung einer Explosion auf ein unbedenkliches Maß beschränken, Ausgabe Juli 2019

REGULATIONS OF GERMAN ACCIDENT INSURERS

[DGUV Regel 112-190](#)

Benutzung von Atemschutzgeräten, Ausgabe November 2021
(in German only)

LINKS

[International Limit Values](#)

[The MAK Collection for Occupational Health and Safety](#)

[DGUV Information 213-098: List of substances - lesson in schools \(in German only\)](#)

REFERENCES

Quelle: 00001

IFA: Erfassungs- und Pflegehandbuch der GESTIS-Stoffdatenbank (nicht öffentlich)

Data acquisition and maintenance manual of the GESTIS substance database (non-public)

Quelle: 00302

G. Hommel "Handbuch der gefährlichen Güter" ("Handbook of Dangerous Goods"), CD-ROM
"Hommel interaktiv" ab Version 10.0 Springer-Verlag, Heidelberg, 2011

Quelle: 00456

Hazardous Substances Data Bank (HSDB) in PubChem

Quelle: 01211

GHS-Sicherheitsdatenblatt, Merck

GHS Material Safety Data Sheet, Merck

Quelle: 01221

GHS-Sicherheitsdatenblatt, Sigma-Aldrich

GHS Material Safety Data Sheet, Sigma-Aldrich

Quelle: 05158

Kühn-Birett-Merkblätter: 158. Ergänzungslieferung; 2/2003

Quelle: 05300

[TRGS 510](#) "Lagerung von Gefahrstoffen in ortsbeweglichen Behältern" Ausgabe Dezember 2020

Quelle: 06002

L. Roth, U. Weller

"Gefährliche Chemische Reaktionen" Loseblattsammlung mit Ergänzungslieferungen, ecomed-Verlag
("Dangerous chemical reactions" loose-leaf collection with supplement deliveries)

Quelle: 07500

Verordnung (EG) Nr. 1272/2008 des Europäischen Parlaments und des Rates vom 16. Dezember 2008 über die Einstufung, Kennzeichnung und Verpackung von Stoffen und Gemischen, zur Änderung und Aufhebung der Richtlinien 67/548/EWG und 1999/45/EG und zur Änderung der Verordnung (EG) Nr.1907/2006 (EG-GHS-Verordnung)

Quelle: 07580

Bekanntmachung der Liste der wassergefährdenden Stoffe im Bundesanzeiger vom 10.08.2017, zuletzt geändert 24.11.2023

Quelle: 07727

L. Roth "Gefahrstoff-Entsorgung" Loseblattsammlung mit Ergänzungslieferungen, ecomed-Verlag, Landsberg

Quelle: 07902

BAM: Datenbank [Gefahrgut-Schnellinfo](#)

Quelle: 08112

DFG Deutsche Forschungsgemeinschaft: MAK- und BAT-Werte-Liste 2023, Senatskommission zur Prüfung gesundheitsschädlicher Arbeitsstoffe, Mitteilung 59; GMS PUBLISSO

Quelle: 99999

Angabe des Bearbeiters

Indication of the editor

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