

SAFETY DATA SHEET

according to regulation (EG) Nr. 1907/2006



Date of issue: 09.10.2013

Revision date: 16.01.2017

Version: 2.2

1. IDENTIFICATION OF THE SUBSTANCE / MIXTURE AND OF THE COMPANY / UNDERTAKING

1.1 Product identifiers

| | |
|---------------------------|-----------------------------------|
| Product name: | Boron trifluoride (B-11 labelled) |
| CAS-No. (labeled): | 20654-88-0 |
| CAS-No. (non-labelled): | 7637-07-2 |
| EC No. (non-labeled): | 231-569-5 |
| Index-No. (non-labelled): | 005-001-00-X |
| REACH Registration no.: | Substance is pre-registered |

1.2 Relevant identified uses of the substance or mixture and uses advised against

| | |
|------------------|-------------------------------------|
| Identified uses: | Chemical, doping of Semiconductors. |
|------------------|-------------------------------------|

1.3 Details of the supplier of the safety data sheet

| | |
|------------|--|
| Supplier: | NUKEM Isotopes GmbH, Industriestrasse 13, 63755 Alzenau, Germany |
| Telephone: | +49 (0)6023 91 1726 |
| Telefax: | +49 (0)6023 91 1614 |
| Email: | Christian.Schuch@nukemisotopes.de |

1.4 Emergency telephone number

| | |
|-----------------------------|--|
| 24 hr. Emergency Telephone: | +1-703-253-4254 (English / Contract No.: 01009) |
|-----------------------------|--|

2. HAZARDS INDICATION

2.1 Classification of the substance or mixture

Classification according to regulation (EC) No. 1272/2008

Liquefied Gas, H280
Acute toxicity, Category 2, H330
Skin Corrosion, Category 1A, H314

For the full text of the H-phrases mentioned in this section, see section 2.2.

Classification according to directive 67/548/EEG or directive 1999/45/EG

T; Toxic
C; Corrosive

R-phrases:

R14: Reacts violently with water.
R23: Toxic by inhalation
R35: Causes severe burns

2.2 Label elements

Labeling according to regulation (EG) No. 1272/2008

The substance is classified and labelled according to the CLP regulation.

Hazard Pictograms:



GHS04



GHS05



GHS06

SAFETY DATA SHEET

according to regulation (EG) Nr. 1907/2006



Date of issue: 09.10.2013

Revision date: 16.01.2017

Version: 2.2

Signal word:

Danger

Hazard statements for physical hazards:

H280 Contains gas under pressure; may explode if heated.

Hazard statements for health hazards:

H314 Causes severe skin burns and eye damage.

H330 Fatal if inhaled.

Precautionary Statements (Prevention):

P260 Do not breathe gas/vapors.

P280 Wear protective gloves/protective clothing/eye protection/face protection.

Response:

P303 + P361 + P353 If on skin (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water.

P304 + P340 If inhaled: Remove to fresh air and keep at rest in a position comfortable for breathing.

P305 + P351 + P338 If in eye: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P315 Get immediate medical advice/attention.

Storage:

P403 Store in a well-ventilated place.

P405 Store locked up.

Supplemental Hazard Statement - EUH-phrases:

EUH014 Reacts violently with water.

EUH071 Corrosive to the respiratory tract.

2.3 Other hazards

Information pertaining to special dangers for human and environment:

Reacts violently with water. Dangerous substances are released in case of decomposition. Gas/vapor is heavier than air. May accumulate in confined spaces, particularly at or below ground level. Contact with liquid may cause cold burns/frostbite. All chemicals are potentially dangerous. They should only be handled by specially trained personnel.

Results of PBT- und vPvB-assessment:

PBT / vPvB: Not applicable.

3. COMPOSITION / INFORMATION ON INGREDIENTS

3.1 Chemical characterization

Substance:

CAS No. (description): 20654-88-0 (B-11 labelled boron trifluoride anhydrous)

CAS-No. (non-labelled): 7637-07-2

EC No. (non labeled): 231-569-5

Formula: BF₃

Molar mass [g/mol]: 67,81

SAFETY DATA SHEET

according to regulation (EG) Nr. 1907/2006

Date of issue: 09.10.2013

Revision date: 16.01.2017



Version: 2.2

4. FIRST AID MEASURES

4.1 Description of first aid measures

General information:

Remove contaminated soaked clothing immediately. Adhere to personal protective measures when giving first aid. Seek medical treatment immediately.

Oral exposure:

Oral poisoning with gaseous boron trifluoride is not relevant.

After ingestion of solutions:

Rinse the mouth and spit the fluids out. Have the casualty drink at least 1 glass of water. Do not make the casualty vomit. Arrange medical treatment. During spontaneous vomiting hold the head of the casualty low with the body in a prone position (danger of aspiration → damage to the lung!)

Inhalation exposure:

Remove the casualty into fresh air and keep him immobile. In case of breathing difficulties give oxygen. In the event of pulmonary irritation treat initially with corticoid spray, e.g. Ventolair- or Pulmicort- metered-dose. Aerosol (Ventolair and Pulmicort are registered trademarks).

Seek medical treatment immediately. In case of respiratory standstill give artificial respiration by respiratory bag (Ambu bag) or respirator. Send for a doctor.

Dermal exposure:

In case of contact with skin wash off immediately with plenty of water. In case of frostbite rinse with plenty of water. Don't remove clothing. Seek medical treatment immediately.

Eye exposure:

Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call for a doctor immediately.

4.2 Most important symptoms and effects, both acute and delayed

Eyes:

Burning pain and swelling. Damage to the cornea. In extreme cases blindness through contact with concentrated solutions.

Skin:

Burning pain. Frostbite and chemical burns due to the super cooled expanded liquid from compressed gas cylinders. Malacia of the soft tissue up to the muscles (with later formation of scar) (contact with concentrated aqueous solutions).

Inhalation:

Strong irritation through to chemical burns to the mucous membranes Bronchitis, dyspnoea, pneumonia. Pain in the chest. Toxic pulmonary edema through moderately high gas/aerosol concentrations. Rapid death possible as a consequence of bronchial spasm or laryngeal spasm/ glottic edema through very high concentrations.

Ingestion (only relevant for solutions):

Burning pain to the mucous membranes, Emesis of masses looking like ground coffee.

4.3 Indication of any immediate medical attention and special treatment needed

For skin irritation calcium gluconate gel can be rubbed in until the pain disappears. Chemical burns of the first or second degree can be treated with flumethasone foam spray. After inhalative intake prophylaxis measures for pulmonary edema (topical and intravenous application of glucocorticoids, oxygen, sedation, absolute rest and possible intubation) should be carried out as well as support of the function of the circulatory system (no adrenalin). For every chemical burn post observation of the casualty in hospital should follow.

SAFETY DATA SHEET

according to regulation (EG) Nr. 1907/2006

Date of issue: 09.10.2013

Revision date: 16.01.2017



Version: 2.2

5. FIRE FIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing agents:

Substance is incombustible. Select firefighting measures according to the surrounding conditions. In the case of fire advise fire fighters on the presence of gas cylinders. If possible, take container out of dangerous zone.

For safety reasons unsuitable extinguishing agents:

Avoid contact with water.

5.2 Special hazards arising from the substance or mixture

Rise in pressure and risk of bursting when heating. Be watchful for frostbite in case of contact with fluid. In the event of fire Hydrogen fluoride (HF), fluorine and / or fluoroboric acid can be released.

5.3 Advice for firefighters

Protective equipment:

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

Specific Hazard(s):

In the event of fire hydrogen fluoride (HF), fluorine and / or fluoroboric acid can be released.

Additional information:

Keep containers cool by spraying with water if exposed to fire. Avoid direct contact with water. Contaminated extinguishing water must be disposed of in accordance with official regulations.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Wear respiratory protection. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and material for containment and cleaning up

Do not flush with water.

6.4 Reference to other sections

See Section 7 for information on safe handling. See Section 8 for information on personal protection equipment. See Section 13 for disposal information.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapor or mist.

7.2 Conditions for safe storage, including any incompatibilities

Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Never allow product to get in contact with water during storage. Contents under pressure.

7.3 Specific end use(s)

No further relevant information available.

SAFETY DATA SHEET

according to regulation (EG) Nr. 1907/2006

Date of issue: 09.10.2013

Revision date: 16.01.2017



Version: 2.2

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control Parameters

Occupational exposure limits:

Boron Trifluoride (Germany): 0,35 ml/m³ or 1,00 mg/m³

Peak limitation (Excursion factor): 2

Additional exposure limits under the conditions of use:

Not available.

DNEL/DMEL and PNEC-Values:

DNEL (inhalation-local effects): 1,00 mg/m³

DNEL (inhalation-systemic effects): 1,00 mg/m³

8.2 Exposure controls

Appropriate engineering controls:

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Individual protection measures, such as personal protective equipment:

Body protection:

Complete suit protecting against chemicals. Flame retardant protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection:

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Eye protection:

Tightly fitting safety goggles. Face shield (8-inch minimum). Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Hand protection:

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands. The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.

8.3 Environmental exposure controls:

Prevent further leakage if safe to do so. Do not let product enter drains.

9. PHYSICAL/CHEMICAL PROPERTIES

General Information

| | |
|------------------------------|---------------------------|
| Appearance: | Form: Gaseous |
| Odor: | No information available |
| Odor threshold: | No information available |
| pH-value (50 g/l) at 50 °C: | No information available |
| Melting point/Melting range: | -128.7 °C |
| Boiling point/Boiling range: | -101.3 °C |
| Flash point: | No information available. |

SAFETY DATA SHEET

according to regulation (EG) Nr. 1907/2006



Date of issue: 09.10.2013

Revision date: 16.01.2017

Version: 2.2

| | |
|---|--|
| Flammability (solid, gaseous): | No information available. |
| Ignition temperature: | Substance do not ignite. |
| Decomposition temperature: | Decomposition when heated. |
| Self-igniting: | No information available. |
| Danger of explosion: | Product does not present an explosion hazard. |
| Explosion limits: | Lower: No information available. Upper: No information available. |
| Oxidizing properties: | No information available. |
| Vapor pressure at -30 °C: | 28 bar |
| Vapor pressure at -12 °C: | 50 bar |
| Vapor density (0 °C, 1013 mbar): | 3.0435 kg/m ³ |
| Density of liquid (at bp): | 1.589 kg/l |
| Evaporation rate: | No information available. |
| Solubility in / Miscibility with water at 6 °C: | 3690 g/l |
| Partition coefficient (n-octanol/water): | No information available. |
| Viscosity, dynamic: | No information available. |

10. STABILITY AND REACTIVITY

10.1 Reactivity

Boron trifluoride is rapidly hydrolyzed in the air and on the moist mucous membranes to form fluoroboric acid and (probably small amounts of) hydrofluoric acid as well as boric acid (here toxicologically not relevant).

10.2 Chemical stability

No Information available.

10.3 Possibility of hazardous reactions

React violently with water.

10.4 Conditions to avoid

Contact with water or moisture.

10.5 Incompatible materials:

The substance can react dangerously with:

Alkali metals. Alkyl nitrates. Butadiene. Ethylene oxide. Alkaline-earth metals

10.6 Hazardous decomposition products:

Fluorine and hydrogen fluoride

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity:

LD/LC50 values relevant for classification:

- Inhalative LC50/4h: 419 ppm (rat) (GESTIS)

Primary irritant effect:

On the skin:

- Corrosive

On the eye:

- Strong corrosive
- Burns, risk of blindness

SAFETY DATA SHEET

according to regulation (EG) Nr. 1907/2006

Date of issue: 09.10.2013

Revision date: 16.01.2017



Version: 2.2

-
- Swelling

After inhalation:

- May be fatal if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract

Sensitization, germ cell mutagenicity, carcinogenicity, reproductive toxicity, aspiration hazard and specific target organ toxicity – single exposure:

- No information available.

Specific target organ toxicity - repeated exposure:

- Once absorbed into the organism, fluoride is not metabolized but almost completely excreted unchanged via the kidneys (at least the proportion which is not deposited into the bones or teeth)

Further information:

The product should be handled with the care usual when dealing with chemicals.

11.2 Signs and Symptoms of exposure

Salivation, nausea, abdominal pain, vomiting, fever, rapid respiration, coughing, wheezing, laryngitis and/or headache.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Aquatic toxicity:

Fish toxicity:

- LC50 22 - 46 mg/l/96 h (Leuciscus idus) (DIN 38412 Part 15)

Daphnia toxicity:

- EC50 21.3 mg/l/48 h (Daphnia magna) (DIN/EN/ISO 6341)

12.2 Persistence and degradability

No information available

12.3 Bioaccumulative potential

No information available.

12.4 Mobility in soil

No information available.

12.5 Results of PBT and vPvB assessment

PBT: Not applicable.

vPvB: Not applicable.

12.6 Other adverse effects

Acutely harmful for aquatic organisms. Do not release untreated into natural waters. Due to the pH-value of the product, neutralization is generally required before discharging sewage into treatment plants. Inhibition of degradation activity in activated sludge is not to be anticipated during correct introduction of low concentrations. The local regulations on waste-water treatment must be followed.

13. DISPOSAL CONSIDERATIONS

13.1 Waste Treatment methods

Product:

Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging:

Dispose of as unused product.

SAFETY DATA SHEET

according to regulation (EG) Nr. 1907/2006

Date of issue: 09.10.2013

Revision date: 16.01.2017



Version: 2.2

14. TRANSPORT INFORMATION

14.1 UN-Number

ADR/RID, IMDG, IATA: 1008

14.2 UN proper shipping name

ADR/RID: BORON TRIFLUORIDE
IMDG: BORON TRIFLUORIDE
IATA: Boron trifluoride
Passenger Aircraft: Not permitted for transport
Cargo Aircraft: Not permitted for transport

14.3 Transport hazard class(es)

ADR/RID, IMDG, IATA:
Class: 2.3 (8)
Label: 2.3 (8)



14.4 Packing group

ADR, IMDG, IATA: -

14.5 Environmental hazards:

ADR/RID: No
IMDG (Marine pollutant): No
IATA: No

14.6 Special precautions for user **Warning: Corrosive substances.**

EmS: F-C, S-U

14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code:

No information available.

14.8 Transport/Additional information

No Information available.

15. REGULATORY INFORMATION

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations:

Information about limitation of use: In dealing with chemicals the national laws must be observed.

15.2 Chemical safety assessment

No information available.

16. OTHER INFORMATION

Disclaimer

Product is supplied for research and laboratory use only. Not for drug, household or other uses.

Warranty

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. See invoice or packing slip for additional terms and conditions of sale.