SAFETY DATA SHEET

SPECIALTY ELECTRONIC MATERIALS SWITZERLAND GMBH

Product name: MOLYKOTE® D-321 R Anti-Friction Coating Spray **Issue Date:** 2023.09.13
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SPECIALTY ELECTRONIC MATERIALS SWITZERLAND GMBH encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: MOLYKOTE® D-321 R Anti-Friction Coating Spray

Recommended use of the chemical and restrictions on use
Identified uses: Lubricants and lubricant additives

COMPANY IDENTIFICATION
SPECIALTY ELECTRONIC MATERIALS
SWITZERLAND GMBH
GROSSMATTE 4
6014 LUZERN
SWITZERLAND

Customer Information Number: 00800-3876-6838
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EMERGENCY TELEPHONE NUMBER
24-Hour Emergency Contact: +(41)- 435082011
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2. HAZARDS IDENTIFICATION

Classification of the substance or mixture
Aerosols - Category 1 - H222, H229
Specific target organ toxicity - repeated exposure - Category 2 - H373
Long-term (chronic) aquatic hazard - Category 3 - H412
For the full text of the H-Statements mentioned in this Section, see Section 16.

Label elements

Hazard pictograms

Signal word: DANGER

Hazard statements

H222	Extremely flammable aerosol.
H229	Pressurised container: May burst if heated.
H373	May cause damage to organs (Central nervous system) through prolonged or repeated exposure.
H412	Harmful to aquatic life with long lasting effects.

Precautionary statements

P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P211	Do not spray on an open flame or other ignition source.
P251	Do not pierce or burn, even after use.
P260	Do not breathe dust or mist.
P260	Do not breathe spray.
P271	Use only outdoors or in a well-ventilated area.
P410 + P412	Protect from sunlight. Do not expose to temperatures exceeding 50 °C/ 122 °F.

Supplemental information

EUH066 Repeated exposure may cause skin dryness or cracking.

The following percentage of the mixture consists of ingredient(s) with unknown acute dermal toxicity: 1.6 %

Contains Naphtha (petroleum), hydrodesulfurized heavy

Other hazards

This product contains no substances assessed to be PBT or vPvB at levels of 0.1% or higher.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical nature: Molybdenum disulfide, aerosol

This product is a mixture.

CASRN / EC-No. / Index-No.	Concentration	Component	Classification
CASRN 123-86-4 **EC-No.** 204-658-1 **Index-No.** 607-025-00-1	>= 10.0 - < 20.0 %	n-Butyl Acetate	Flam. Liq. - 3 - H226 STOT SE - 3 - H336
CASRN 64742-82-1	>= 2.5 - < 10.0 %	Naphtha (petroleum), hydrodesulfurized heavy	Flam. Liq. - 3 - H226 STOT SE - 3 - H336

EC-No. 265-185-4 **Index-No.** 649-330-00-2			STOT RE - 1 - H372 Asp. Tox. - 1 - H304 Aquatic Chronic - 2 - H411
CASRN 9022-96-2 **EC-No.** Polymer **Index-No.** –	>= 1.0 - < 10.0 %	Polybutyl titanate	Flam. Liq. - 3 - H226 Eye Irrit. - 2 - H319
CASRN 1314-13-2 **EC-No.** 215-222-5 **Index-No.** 030-013-00-7	>= 0.1 - < 0.25 %	Zinc oxide	Aquatic Acute - 1 - H400 Aquatic Chronic - 1 - H410
CASRN 106-97-8 **EC-No.** 203-448-7 **Index-No.** 601-004-00-0	>= 50.0 - < 60.0 %	Butane (containing < 0.1% butadiene)	Flam. Gas - 1 - H220 Press. Gas - Compr. Gas - H280
CASRN 74-98-6 **EC-No.** 200-827-9 **Index-No.** 601-003-00-5	>= 10.0 - < 20.0 %	Propane	Flam. Gas - 1 - H220 Press. Gas - Compr. Gas - H280
CASRN 1317-33-5 **EC-No.** 215-263-9 **Index-No.** –	>= 1.0 - < 10.0 %	Molybdenum disulfide	Not classified
CASRN 7782-42-5 **EC-No.** 231-955-3 **Index-No.** –	>= 1.0 - < 10.0 %	Graphite	Not classified

For the full text of the H-Statements mentioned in this Section, see Section 16.

Note

Naphtha (petroleum), hydrodesulfurized heavy:

The classification as a carcinogen or mutagen need not to apply because the substance contains less than 0.1% w/w benzene (EINECS No 200-753-7). Note P of Annex VI to Regulation (EC) 1272/2008.

4. FIRST AID MEASURES

Description of first aid measures
General advice: First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists refer to Section 8 for specific personal protective equipment.

Inhalation: Move person to fresh air. If not breathing, give artificial respiration; if by mouth to mouth use rescuer protection (pocket mask, etc). If breathing is difficult, oxygen should be administered by qualified personnel. Call a physician or transport to a medical facility.

Skin contact: Wash off with plenty of water.

Eye contact: Flush eyes thoroughly with water for several minutes. Remove contact lenses after the initial 1-2 minutes and continue flushing for several additional minutes. If effects occur, consult a physician, preferably an ophthalmologist.

Ingestion: No emergency medical treatment necessary.

Most important symptoms and effects, both acute and delayed:
Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), any additional important symptoms and effects are described in Section 11: Toxicology Information.

Indication of any immediate medical attention and special treatment needed
Notes to physician: Maintain adequate ventilation and oxygenation of the patient. May cause asthma-like (reactive airways) symptoms. Bronchodilators, expectorants, antitussives and corticosteroids may be of help. Exposure may increase "myocardial irritability". Do not administer sympathomimetic drugs such as epinephrine unless absolutely necessary. No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient. Repeated excessive exposure may aggravate preexisting lung disease.

5. FIREFIGHTING MEASURES

Extinguishing media

Suitable extinguishing media: Water spray. Alcohol-resistant foam. Carbon dioxide (CO2). Dry chemical.

Unsuitable extinguishing media: Do not use direct water stream..

Special hazards arising from the substance or mixture

Hazardous combustion products: Carbon oxides. Sulphur oxides.

Unusual Fire and Explosion Hazards: Flash back possible over considerable distance.. May form explosive mixtures in air.. Exposure to combustion products may be a hazard to health.. If the temperature rises there is danger of the vessels bursting due to the high vapor pressure.. Vapours may form explosive mixtures with air..

Advice for firefighters

Fire Fighting Procedures: Collect contaminated fire extinguishing water separately. This must not be discharged into drains.. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.. Contain fire water run-off if possible. Fire water run-off, if not contained, may cause environmental damage.. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed.. EXPLOSION HAZARD. Fight advanced fires from a protected location.. Do not use a solid water stream as it may scatter and spread fire..
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Fight fire remotely due to the risk of explosion. Use water spray to cool unopened containers. Collect contaminated fire extinguishing water separately. This must not be discharged into drains. Remove undamaged containers from fire area if it is safe to do so. Evacuate area.

Special protective equipment for firefighters: In the event of fire, wear self-contained breathing apparatus.. Use personal protective equipment..

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures: Remove all sources of ignition. Use personal protective equipment. Follow safe handling advice and personal protective equipment recommendations.

Environmental precautions: Do not release the product to the aquatic environment above defined regulatory levels Prevent further leakage or spillage if safe to do so. Prevent spreading over a wide area (e.g. by containment or oil barriers). Retain and dispose of contaminated wash water. Local authorities should be advised if significant spillages cannot be contained.

Methods and materials for containment and cleaning up: Non-sparking tools should be used. Soak up with inert absorbent material. Suppress (knock down) gases/vapours/mists with a water spray jet. Clean up remaining materials from spill with suitable absorbant. Local or national regulations may apply to releases and disposal of this material, as well as those materials and items employed in the cleanup of releases. You will need to determine which regulations are applicable. For large spills, provide dyking or other appropriate containment to keep material from spreading. If dyked material can be pumped, Sections 13 and 15 of this SDS provide information regarding certain local or national requirements.
See sections: 7, 8, 11, 12 and 13.

7. HANDLING AND STORAGE

Precautions for safe handling: Avoid inhalation of vapour or mist. Do not swallow. Avoid contact with eyes. Avoid prolonged or repeated contact with skin. Keep away from heat and sources of ignition. Take precautionary measures against static discharges. Take care to prevent spills, waste and minimize release to the environment. Close valve after each use and when empty. Do NOT change or force fit connections. Open the valves slowly to prevent pressure surges. Handle in accordance with good industrial hygiene and safety practice. Do not spray on an open flame or other ignition source.
Use with local exhaust ventilation. Use only in an area equipped with explosion proof exhaust ventilation. See Engineering measures under EXPOSURE CONTROLS/PERSONAL PROTECTION section.

Conditions for safe storage: Keep in a cool, well-ventilated place. Keep away from direct sunlight. Store in accordance with the particular national regulations. Do not pierce or burn, even after use. Keep cool. Protect from sunlight.

Do not store with the following product types: Oxidizing agents. Self-reactive substances and mixtures. Organic peroxides. Flammable solids. Pyrophoric liquids. Pyrophoric solids. Self-heating substances and mixtures. Substances and mixtures, which in contact with water, emit flammable gases. Explosives.
Unsuitable materials for containers: None known.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters
If exposure limits exist, they are listed below. If no exposure limits are displayed, then no values are applicable.

Component	Regulation	Type of listing	Value
n-Butyl Acetate	ACGIH	TWA	50 ppm
	Further information: URT irr: Upper Respiratory Tract irritation; eye irr: Eye irritation		
	ACGIH	STEL	150 ppm
	Further information: URT irr: Upper Respiratory Tract irritation; eye irr: Eye irritation		
	ARE OEL	TWA	713 mg/m3 150 ppm
	ARE OEL	STEL	950 mg/m3 200 ppm
	2019/1831/EU	STEL	723 mg/m3 150 ppm
	Further information: Indicative		
	2019/1831/EU	TWA	241 mg/m3 50 ppm
	Further information: Indicative		
Zinc oxide	ACGIH	TWA Respirable particulate matter	2 mg/m3
	ACGIH	STEL Respirable particulate matter	10 mg/m3
Butane (containing < 0.1% butadiene)	ACGIH	STEL	1,000 ppm
	Further information: EX: Explosion hazard: the substance is a flammable asphyxiant or excursions above the TLV® could approach 10% of the lower explosive limit.; CNS impair: Central Nervous System impairment		
	ARE OEL	TWA	800 ppm
	ARE OEL	TWA	800 ppm
Propane	ACGIH		See Further information
	Further information: See Appendix F: Minimal Oxygen Content; EX: Explosion hazard: the substance is a flammable asphyxiant or excursions above the TLV® could approach 10% of the lower explosive limit.; asphyxia: Asphyxia; D: Simple asphyxiant; see discussion covering Minimal Oxygen Content found in the 'Definitions and Notations' section following the NIC tables		
	ARE OEL	TWA	800 ppm
Molybdenum disulfide	ACGIH	TWA Inhalable particulate matter	10 mg/m3 , Molybdenum
	ACGIH	TWA Respirable particulate matter	3 mg/m3 , Molybdenum
	ARE OEL	TWA Respirable dust	3 mg/m3 , Molybdenum
	ARE OEL	TWA Measured as inhalable fraction of the aerosol.	10 mg/m3 , Molybdenum

Graphite	ACGIH	TWA Respirable particulate matter	2 mg/m3
	Further information: pneumoconiosis: Pneumoconiosis		
	ARE OEL	TWA Respirable dust	2 mg/m3
	ARE OEL	TWA Respirable dust	2 mg/m3

This material contains a simple asphyxiant which may displace oxygen. Insure adequate ventilation to prevent an oxygen deficient atmosphere.
The following substance(s), which have Occupational Exposure Limit(s) (OEL), may be formed during handling or processing:
butanol

Exposure controls
Engineering controls: Use engineering controls to maintain airborne level below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, use only in enclosed systems or with local exhaust ventilation. Exhaust systems should be designed to move the air away from the source of vapor/aerosol generation and people working at this point. Lethal concentrations may exist in areas with poor ventilation.

Individual protection measures

Eye/face protection: Use safety glasses (with side shields). Safety glasses (with side shields) should be consistent with EN 166 or equivalent. If exposure causes eye discomfort, use a full-face respirator (meeting standard EN 136) with organic vapor cartridge (meeting standard EN 14387).

Skin protection

Hand protection: Use gloves chemically resistant to this material when prolonged or frequently repeated contact could occur. Use chemical resistant gloves classified under Standard EN374: Protective gloves against chemicals and micro-organisms. Examples of preferred glove barrier materials include: Chlorinated polyethylene. Neoprene. Nitrile/butadiene rubber ("nitrile" or "NBR"). Polyethylene. Ethyl vinyl alcohol laminate ("EVAL"). Polyvinyl alcohol ("PVA"). Viton. Examples of acceptable glove barrier materials include: Butyl rubber. Natural rubber ("latex"). Polyvinyl chloride ("PVC" or "vinyl"). When prolonged or frequently repeated contact may occur, a glove with a protection class of 4 or higher (breakthrough time greater than 120 minutes according to EN 374) is recommended. When only brief contact is expected, a glove with a protection class of 1 or higher (breakthrough time greater than 10 minutes according to EN 374) is recommended. Glove thickness alone is not a good indicator of the level of protection a glove provides against a chemical substance as this level of protection is also highly dependent on the specific composition of the material that the glove is fabricated from. The thickness of the glove must, depending on model and type of material, generally be more than 0.35 mm to offer sufficient protection for prolonged and frequent contact with the substance. As an exception to this general rule it is known that multilayer laminate gloves may offer prolonged protection at thicknesses less than 0.35 mm. Other glove materials with a thickness of less than 0.35 mm may offer sufficient protection when only brief contact is expected. NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

Other protection: Wear clean, body-covering clothing.

Respiratory protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, use an approved respirator. When respiratory protection is required, use an approved positive-pressure self-contained breathing apparatus or positive-pressure airline with auxiliary self-contained air supply. For emergency conditions, use an approved positive-pressure self-contained breathing apparatus. In confined or poorly ventilated areas, use an approved self-contained breathing apparatus or positive pressure air line with auxiliary self-contained air supply.

See SECTION 7: Handling and storage and SECTION 13: Disposal considerations for measures to prevent excessive environmental exposure during use and waste disposal.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	
Physical state	Aerosol containing a dissolved gas
Color	black
Odor	solvent-like
Odor Threshold	No data available
pH	Not applicable
Melting point/range	No data available
Freezing point	No data available
Boiling point (760 mmHg)	Not applicable
Flash point	Not applicable
Evaporation Rate (Butyl Acetate = 1)	Not applicable
Flammability (solid, gas)	Extremely flammable aerosol.
Lower explosion limit	No data available
Upper explosion limit	No data available
Vapor Pressure	No data available
Relative Vapor Density (air = 1)	No data available
Relative Density (water = 1)	1.05
Water solubility	No data available
Partition coefficient: n-octanol/water	No data available
Auto-ignition temperature	No data available
Decomposition temperature	No data available
Dynamic Viscosity	Not applicable
Kinematic Viscosity	Not applicable
Explosive properties	Not explosive
Oxidizing properties	The substance or mixture is not classified as oxidizing.
Molecular weight	No data available
Particle size	Not applicable

NOTE: The physical data presented above are typical values and should not be construed as a specification.

10. STABILITY AND REACTIVITY

Reactivity: Not classified as a reactivity hazard.

Chemical stability: Stable under normal conditions.

Possibility of hazardous reactions: Can react with strong oxidizing agents. If the temperature rises there is danger of the vessels bursting due to the high vapor pressure. Vapours may form explosive mixture with air. Extremely flammable aerosol.

Conditions to avoid: Heat, flames and sparks.

Incompatible materials: Oxidizing agents

Hazardous decomposition products:
Decomposition products can include and are not limited to: Butanol.

11. TOXICOLOGICAL INFORMATION

Toxicological information appears in this section when such data is available.

Acute toxicity

Acute oral toxicity
Product test data not available. Refer to component data.

Acute dermal toxicity
Product test data not available. Refer to component data.

Acute inhalation toxicity
Product test data not available. Refer to component data.

Skin corrosion/irritation
Repeated exposure may cause skin dryness or cracking.

Serious eye damage/eye irritation
Product test data not available. Refer to component data.

Sensitization
Product test data not available. Refer to component data.

Specific Target Organ Systemic Toxicity (Single Exposure)
Product test data not available. Refer to component data.

Specific Target Organ Systemic Toxicity (Repeated Exposure)
Product test data not available. Refer to component data.

Carcinogenicity
Product test data not available. Refer to component data.

Teratogenicity
Product test data not available. Refer to component data.

Reproductive toxicity
Product test data not available. Refer to component data.

Mutagenicity
Product test data not available. Refer to component data.

Aspiration Hazard
Product test data not available. Refer to component data.

COMPONENTS INFLUENCING TOXICOLOGY:

n-Butyl Acetate

Acute oral toxicity
LD50. Rat. male. 12,789 mg/kg

LD50 Oral. Rat. female. 10,760 mg/kg

Acute dermal toxicity
LD50. Rabbit. male and female. > 14,112 mg/kg

Acute inhalation toxicity
The LC50 has not been determined.

Serious eye damage/eye irritation
May cause moderate eye irritation.
Corneal injury is unlikely.
Vapor may cause eye irritation experienced as mild discomfort and redness.

Sensitization
Did not cause allergic skin reactions when tested in guinea pigs.
Did not cause allergic skin reactions when tested in humans.

For respiratory sensitization:
No relevant data found.

Specific Target Organ Systemic Toxicity (Single Exposure)
May cause drowsiness or dizziness.
Route of Exposure: Inhalation
Target Organs: Nervous system

Specific Target Organ Systemic Toxicity (Repeated Exposure)
Based on available data, repeated exposures are not anticipated to cause additional significant adverse effects.

Carcinogenicity
No relevant data found.

Teratogenicity
Has been toxic to the fetus in laboratory animals at doses toxic to the mother. Did not cause birth defects in laboratory animals.

Reproductive toxicity
In laboratory animal studies, effects on reproduction have been seen only at doses that produced significant toxicity to the parent animals. In animal studies, did not interfere with fertility. No toxicity to reproduction

Mutagenicity
In vitro genetic toxicity studies were negative.

Aspiration Hazard
Aspiration into the lungs may occur during ingestion or vomiting, causing lung damage or even death due to chemical pneumonia.

Naphtha (petroleum), hydrodesulfurized heavy

Acute oral toxicity
Based on data from similar materials LD50. Rat. male and female. > 5,000 mg/kg

Acute dermal toxicity
Based on data from similar materials LD50. Rat. male and female. > 4,000 mg/kg No deaths occurred at this concentration.

Acute inhalation toxicity
Based on data from similar materials LC50. Rat. 4 Hour. vapour. > 13.1 mg/l

Serious eye damage/eye irritation
May cause slight temporary eye irritation.
Corneal injury is unlikely.

Sensitization
For skin sensitization:
For similar material(s):
Did not cause allergic skin reactions when tested in guinea pigs.

For respiratory sensitization:
No relevant data found.

Specific Target Organ Systemic Toxicity (Single Exposure)
May cause drowsiness or dizziness.

Specific Target Organ Systemic Toxicity (Repeated Exposure)
For similar material(s):
In humans, effects have been reported on the following organs:
Central nervous system.

Carcinogenicity
No relevant data found.

Teratogenicity
For similar material(s): Has caused birth defects in laboratory animals only at doses toxic to the mother. Has been toxic to the fetus in laboratory animals at doses toxic to the mother.

Reproductive toxicity
For similar material(s): In animal studies, did not interfere with fertility.

Mutagenicity

For similar material(s): In vitro genetic toxicity studies were negative. Animal genetic toxicity studies were negative.

Aspiration Hazard
May be fatal if swallowed and enters airways.

Polybutyl titanate

Acute oral toxicity
LD50. Rat. > 2,000 mg/kg

Acute dermal toxicity
LD50. Rat. > 5,000 mg/kg

Acute inhalation toxicity
The LC50 has not been determined.

Serious eye damage/eye irritation
May cause severe eye irritation.

Sensitization
For skin sensitization:
No relevant data found.

For respiratory sensitization:
No relevant data found.

Specific Target Organ Systemic Toxicity (Single Exposure)
Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Specific Target Organ Systemic Toxicity (Repeated Exposure)
No relevant data found.

Carcinogenicity
No relevant data found.

Teratogenicity
No relevant data found.

Reproductive toxicity
No relevant data found.

Mutagenicity
No relevant data found.

Aspiration Hazard
Based on physical properties, not likely to be an aspiration hazard.

Zinc oxide

Acute oral toxicity
LD50. Rat. > 5,000 mg/kg

Acute dermal toxicity
The dermal LD50 has not been determined.

Acute inhalation toxicity
LC50. Rat. 4 Hour. dust/mist. > 5 mg/l No deaths occurred at this concentration.

Serious eye damage/eye irritation
May cause slight temporary eye irritation.
Corneal injury is unlikely.

Sensitization
For skin sensitization:
No relevant data found.

For respiratory sensitization:
No relevant data found.

Specific Target Organ Systemic Toxicity (Single Exposure)
Available data are inadequate to determine single exposure specific target organ toxicity.

Carcinogenicity
Available data are inadequate to evaluate carcinogenicity.

Teratogenicity
No relevant data found.

Reproductive toxicity
In animal studies, did not interfere with reproduction. In animal studies, did not interfere with fertility.

Mutagenicity
In vitro genetic toxicity studies were negative in some cases and positive in other cases.

Aspiration Hazard
Based on physical properties, not likely to be an aspiration hazard.

Butane (containing < 0.1% butadiene)

Acute oral toxicity
Single dose oral LD50 has not been determined.

Acute dermal toxicity
The dermal LD50 has not been determined.

Acute inhalation toxicity
LC50. Rat. 4 Hour. vapour. 658 mg/l

Serious eye damage/eye irritation
No hazard from gas.

Sensitization
For skin sensitization:
No relevant data found.

For respiratory sensitization:
No relevant data found.

Specific Target Organ Systemic Toxicity (Single Exposure)

Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Specific Target Organ Systemic Toxicity (Repeated Exposure)
Based on available data, repeated exposures are not anticipated to cause additional significant adverse effects.

Carcinogenicity
No relevant data found.

Teratogenicity
No relevant data found.

Reproductive toxicity
No relevant data found.

Mutagenicity
In vitro genetic toxicity studies were negative. Animal genetic toxicity studies were negative.

Aspiration Hazard
Based on physical properties, not likely to be an aspiration hazard.

Propane

Acute oral toxicity
Single dose oral LD50 has not been determined.

Acute dermal toxicity
The dermal LD50 has not been determined.

Acute inhalation toxicity
LC50. Rat. male and female. 4 Hour. vapour. > 425000 ppm

Serious eye damage/eye irritation
Essentially nonirritating to eyes.
Liquid may cause frostbite.

Sensitization
For skin sensitization:
No relevant data found.

For respiratory sensitization:
No relevant data found.

Specific Target Organ Systemic Toxicity (Single Exposure)
Available data are inadequate to determine single exposure specific target organ toxicity.

Specific Target Organ Systemic Toxicity (Repeated Exposure)
Based on available data, repeated exposures are not anticipated to cause additional significant adverse effects.

Carcinogenicity
No relevant data found.

Teratogenicity
Screening studies suggest that this material does not affect fetal development.

Reproductive toxicity
In animal studies, did not interfere with reproduction. In animal studies, did not interfere with fertility.

Mutagenicity
In vitro genetic toxicity studies were negative.

Aspiration Hazard
Based on physical properties, not likely to be an aspiration hazard.

Molybdenum disulfide

Acute oral toxicity
LD50. Rat. > 2,000 mg/kg No deaths occurred at this concentration.

Acute dermal toxicity
LD50. Rat. male and female. > 2,000 mg/kg No deaths occurred at this concentration.

Serious eye damage/eye irritation
May cause slight temporary eye irritation.
Corneal injury is unlikely.

Sensitization
For skin sensitization:
Did not cause allergic skin reactions when tested in guinea pigs.

For respiratory sensitization:
No relevant data found.

Specific Target Organ Systemic Toxicity (Single Exposure)
Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Specific Target Organ Systemic Toxicity (Repeated Exposure)
No relevant data found.

Carcinogenicity
No relevant data found.

Teratogenicity
No relevant data found.

Reproductive toxicity
No relevant data found.

Mutagenicity
For similar material(s): In vitro genetic toxicity studies were negative.

Aspiration Hazard
Based on physical properties, not likely to be an aspiration hazard.

Graphite

Acute oral toxicity
LD50. Rat. > 2,000 mg/kg OECD Test Guideline 423

Acute dermal toxicity
The dermal LD50 has not been determined.

Acute inhalation toxicity
An LC50/inhalation/4h/rat could not be determined because no mortality of rats was observed at the maximum achievable concentration. LC50. Rat. 4 Hour. dust/mist. > 2 mg/l OECD Test Guideline 403

Serious eye damage/eye irritation
May cause slight temporary eye irritation.

Sensitization
Did not demonstrate the potential for contact allergy in mice.

Specific Target Organ Systemic Toxicity (Single Exposure)
The substance or mixture is not classified as specific target organ toxicant, single exposure.

Specific Target Organ Systemic Toxicity (Repeated Exposure)
Based on available data, repeated exposures are not anticipated to cause significant adverse effects.

Teratogenicity
Did not cause birth defects or any other fetal effects in laboratory animals.

Reproductive toxicity
In animal studies, did not interfere with reproduction.

Mutagenicity
In vitro genetic toxicity studies were negative.

Aspiration Hazard
No aspiration toxicity classification

12. ECOLOGICAL INFORMATION

Ecotoxicological information appears in this section when such data is available.

Toxicity

n-Butyl Acetate

Acute toxicity to fish
Material is harmful to aquatic organisms (LC50/EC50/IC50 between 10 and 100 mg/L in the most sensitive species).
LC50. Pimephales promelas (fathead minnow). flow-through test. 96 Hour. 18 mg/l

Acute toxicity to aquatic invertebrates
LC50. Daphnia magna (Water flea). 48 Hour. 44 mg/l

Acute toxicity to algae/aquatic plants
ErC50. Desmodesmus subspicatus (green algae). 72 Hour. Growth rate inhibition. 648 mg/l

Toxicity to bacteria

EC50. Bacteria. 16 Hour. > 1,000 mg/l

Chronic toxicity to aquatic invertebrates
NOEC. Daphnia magna (Water flea). 21 d. 23 mg/l

Naphtha (petroleum), hydrodesulfurized heavy

Acute toxicity to fish
Material is toxic to aquatic organisms (LC50/EC50/IC50 between 1 and 10 mg/L in the most sensitive species).
Based on data from similar materials
LL50. Oncorhynchus mykiss (rainbow trout). 96 Hour. 10 - 30 mg/l. OECD Test Guideline 203

Acute toxicity to aquatic invertebrates
Based on data from similar materials
EL50. Daphnia magna (Water flea). 48 Hour. 10 - 22 mg/l. OECD Test Guideline 202

Acute toxicity to algae/aquatic plants
Based on data from similar materials
EL50. Pseudokirchneriella subcapitata (green algae). 72 Hour. 4.6 - 10 mg/l. OECD Test Guideline 201
Based on data from similar materials
NOELR. Pseudokirchneriella subcapitata (green algae). 72 Hour. 0.22 mg/l. OECD Test Guideline 201

Chronic toxicity to aquatic invertebrates
Based on data from similar materials
NOELR. Daphnia magna (Water flea). 21 d. 0.097 mg/l

Polybutyl titanate

Acute toxicity to fish
Not expected to be acutely toxic to aquatic organisms.

Zinc oxide

Acute toxicity to fish
Material is very toxic to aquatic organisms (LC50/EC50/IC50 below 1 mg/L in the most sensitive species).
LC50. Oncorhynchus mykiss (rainbow trout). static test. 96 Hour. 0.14 - 1.1 mg/l
LC50. Danio rerio (zebra fish). 96 Hour. 1 - 10 mg/l

Acute toxicity to aquatic invertebrates
EC50. Daphnia magna (Water flea). 48 Hour. 1 - 10 mg/l

Acute toxicity to algae/aquatic plants
IC50. Selenastrum capricornutum (green algae). 72 Hour. Growth rate. 0.136 mg/l

Toxicity to bacteria
Based on data from similar materials
EC50. 3 Hour. 5.2 mg/l. OECD Test Guideline 209

Chronic toxicity to fish
NOEC. Danio rerio (zebra fish). 32 d. mortality. >= 0.540 mg/l

Chronic toxicity to aquatic invertebrates
NOEC. Daphnia magna (Water flea). 21 d. number of offspring. 0.04 mg/l

Butane (containing < 0.1% butadiene)

Acute toxicity to fish
Material is toxic to aquatic organisms (LC50/EC50/IC50 between 1 and 10 mg/L in the most sensitive species).

Propane

Acute toxicity to fish
Material is not classified as dangerous to aquatic organisms.

Molybdenum disulfide

Acute toxicity to fish
Material is not classified as dangerous to aquatic organisms (LC50/EC50/IC50/LL50/EL50 greater than 100 mg/L in most sensitive species).
For similar material(s):
LC50. Fish. 96 Hour. > 100 mg/l

Acute toxicity to aquatic invertebrates
Based on data from similar materials
EC50. Daphnia magna (Water flea). 48 Hour. > 100 mg/l

Acute toxicity to algae/aquatic plants
Based on data from similar materials
ErC50. algae. 72 Hour. Growth rate. > 100 mg/l

Toxicity to bacteria
EC50. 30 Hour. Respiration rates.. > 100 mg/l

Chronic toxicity to fish
Based on data from similar materials
NOEC. Fish. 34 d. > 10 mg/l

Chronic toxicity to aquatic invertebrates
Based on data from similar materials
NOEC. Daphnia magna. 21 d. > 10 mg/l

Graphite

Acute toxicity to fish
No toxicity at the limit of solubility
LC50. Danio rerio (zebra fish). 96 Hour. > 100 mg/l. OECD Test Guideline 203

Acute toxicity to aquatic invertebrates
No toxicity at the limit of solubility
EC50. Daphnia magna (Water flea). 48 Hour. > 100 mg/l. OECD Test Guideline 202

Acute toxicity to algae/aquatic plants
EC50. Raphidocelis subcapitata (freshwater green alga). 72 Hour. > 100 mg/l. OECD Test Guideline 201
NOEC. Raphidocelis subcapitata (freshwater green alga). 72 Hour. >= 100 mg/l. OECD Test Guideline 201

Toxicity to bacteria
EC50. 3 Hour. > 1,012.5 mg/l. OECD Test Guideline 209

Persistence and degradability

n-Butyl Acetate

Biodegradability: Material is readily biodegradable. Passes OECD test(s) for ready biodegradability.
10-day Window: Pass
Biodegradation: 83 %
Exposure time: 28 d
Method: OECD Test Guideline 301D or Equivalent

Naphtha (petroleum), hydrodesulfurized heavy

Biodegradability: Material is readily biodegradable. Passes OECD test(s) for ready biodegradability.
Based on data from similar materials 10-day Window: Pass
Biodegradation: 74.7 %
Exposure time: 28 d
Method: OECD Test Guideline 301F

Polybutyl titanate

Biodegradability: Biodegradability is not applicable to inorganic substances.

Zinc oxide

Biodegradability: Biodegradability is not applicable to inorganic substances.

Butane (containing < 0.1% butadiene)

Biodegradability: Material is expected to be readily biodegradable.

Propane

Biodegradability: No relevant data found.

Molybdenum disulfide

Biodegradability: Biodegradability is not applicable to inorganic substances.

Graphite

Biodegradability: Not applicable

Bioaccumulative potential

n-Butyl Acetate

Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).
Partition coefficient: n-octanol/water(log Pow): Pow: 3.2 at 25 °C Measured
Bioconcentration factor (BCF): 15 Fish Estimated.

Naphtha (petroleum), hydrodesulfurized heavy

Bioaccumulation: Based on data from similar materials
Partition coefficient: n-octanol/water(log Pow): > 4

Polybutyl titanate

Bioaccumulation: No relevant data found.

Zinc oxide

Bioaccumulation: Partitioning from water to n-octanol is not applicable.
Bioconcentration factor (BCF): 177 Fish

Butane (containing < 0.1% butadiene)

Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).
Partition coefficient: n-octanol/water(log Pow): 2.89 Measured

Propane

Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).
Partition coefficient: n-octanol/water(log Pow): 2.36 Measured

Molybdenum disulfide

Bioaccumulation: Partitioning from water to n-octanol is not applicable.

Graphite

Bioaccumulation: Not applicable Not applicable

Mobility in soil

n-Butyl Acetate

Potential for mobility in soil is very high (Koc between 0 and 50).
Partition coefficient (Koc): 19 - 70 Estimated.

Naphtha (petroleum), hydrodesulfurized heavy

No relevant data found.

Polybutyl titanate

No relevant data found.

Zinc oxide

No relevant data found.

Butane (containing < 0.1% butadiene)

Potential for mobility in soil is very high (Koc between 0 and 50).
Partition coefficient (Koc): 44 - 900 Estimated.

Propane

Potential for mobility in soil is very high (Koc between 0 and 50).
Partition coefficient (Koc): 24 - 460 Estimated.

Molybdenum disulfide

No relevant data found.

Graphite

No relevant data found.

Results of PBT and vPvB assessment

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

Other adverse effects

n-Butyl Acetate

This substance is not on the Montreal Protocol list of substances that deplete the ozone layer.

Naphtha (petroleum), hydrodesulfurized heavy

This substance is not on the Montreal Protocol list of substances that deplete the ozone layer.

Polybutyl titanate
This substance is not on the Montreal Protocol list of substances that deplete the ozone layer.

Zinc oxide
This substance is not on the Montreal Protocol list of substances that deplete the ozone layer.

Butane (containing < 0.1% butadiene)
This substance is not on the Montreal Protocol list of substances that deplete the ozone layer.

Propane
This substance is not on the Montreal Protocol list of substances that deplete the ozone layer.

Molybdenum disulfide
This substance is not on the Montreal Protocol list of substances that deplete the ozone layer.

Graphite
This substance is not on the Montreal Protocol list of substances that deplete the ozone layer.

13. DISPOSAL CONSIDERATIONS

Disposal methods:
Do not dump into any sewers, on the ground, or into any body of water. This product, when being disposed of in its unused and uncontaminated state should be treated as a hazardous waste according to EC Directive 2008/98/EC. Any disposal practices must be in compliance with all national and provincial laws and any municipal or local by-laws governing hazardous waste. For used, contaminated and residual materials additional evaluations may be required.

14. TRANSPORT INFORMATION

Classification for ROAD and Rail transport:

Proper shipping name	AEROSOLS
UN number	UN 1950
Class	2.1
Packing group	

Classification for SEA transport (IMO-IMDG):

Proper shipping name	AEROSOLS
UN number	UN 1950
Class	2.1
Packing group	
Marine pollutant	No
Transport in bulk according to Annex I or II of MARPOL 73/78 and the IBC or IGC Code	Consult IMO regulations before transporting ocean bulk

Classification for AIR transport (IATA/ICAO):

Proper shipping name	Aerosols, flammable

UN number	UN 1950
Class	2.1
Packing group	

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Transportation classifications may vary by container volume and may be influenced by regional or country variations in regulations. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION

Seveso III: Directive 2012/18/EU of the European Parliament and of the Council on the control of major-accident hazards involving dangerous substances.
Listed in Regulation: FLAMMABLE AEROSOLS
Number in Regulation: P3a
150 t
500 t
Listed in Regulation: Liquefied flammable gases (including LPG) and natural gas
Number in Regulation: 18
50 t
200 t
Listed in Regulation: Petroleum products: (a) gasolines and naphthas, (b) kerosenes (including jet fuels), (c) gas oils (including diesel fuels, home heating oils and gas oil blending streams),(d) heavy fuel oils (e) alternative fuels serving the same purposes and with similar properties as regards flammability and environmental hazards as the products referred to in points (a) to (d)
Number in Regulation: 34
2,500 t
25,000 t

Classification and labeling have been performed according to Regulation (EC) No 1272/2008.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

H220	Extremely flammable gas.
H222	Extremely flammable aerosol.
H226	Flammable liquid and vapour.
H229	Pressurised container: May burst if heated.
H280	Contains gas under pressure; may explode if heated.
H304	May be fatal if swallowed and enters airways.
H319	Causes serious eye irritation.
H336	May cause drowsiness or dizziness.
H372	Causes damage to organs through prolonged or repeated exposure.
H373	May cause damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

H411	Toxic to aquatic life with long lasting effects.
H412	Harmful to aquatic life with long lasting effects.

Revision

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Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

2019/1831/EU	Europe. Commission Directive 2019/1831/EU establishing a fifth list of indicative occupational exposure limit values
ACGIH	USA. ACGIH Threshold Limit Values (TLV)
ARE OEL	Abu Dhabi Emirate - EHSMS Manual, Volume 2, Environment, Health and Safety Protection Policies, Section 2, Part I: EEPP Air Quality Standards
STEL	Short-term exposure limit
TWA	8-hour, time-weighted average
Aquatic Acute	Short-term (acute) aquatic hazard
Aquatic Chronic	Long-term (chronic) aquatic hazard
Asp. Tox.	Aspiration hazard
Eye Irrit.	Eye irritation
Flam. Gas	Flammable gases
Flam. Liq.	Flammable liquids
Press. Gas	Gases under pressure
STOT RE	Specific target organ toxicity - repeated exposure
STOT SE	Specific target organ toxicity - single exposure

Full text of other abbreviations

ADN - European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways; ADR - Agreement concerning the International Carriage of Dangerous Goods by Road; AIIC - Australian Inventory of Industrial Chemicals; ASTM - American Society for the Testing of Materials; bw - Body weight; CLP - Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECHA - European Chemicals Agency; EC-Number - European Community number; ECx - Concentration associated with x% response; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; n.o.s. - Not Otherwise Specified; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RID - Regulations concerning the International Carriage of Dangerous

Goods by Rail; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; SVHC - Substance of very high concern; TCSI - Taiwan Chemical Substance Inventory; TECI - Thailand Existing Chemicals Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

Information Source and References
This SDS is prepared by Product Regulatory Services and Hazard Communications Groups from information supplied by internal references within our company.

SPECIALTY ELECTRONIC MATERIALS SWITZERLAND GMBH urges each customer or recipient of this (M)SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this (M)SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific (M)SDSs, we are not and cannot be responsible for (M)SDSs obtained from any source other than ourselves. If you have obtained an (M)SDS from another source or if you are not sure that the (M)SDS you have is current, please contact us for the most current version.

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