MOLYKOTE® 1000 Paste

Solid lubricant paste for bolted metal joints; contains no lead or nickel

Features & benefits

- Can be used over a wide range of temperatures (-30°C/-22°F to +650°C/1,202°F)
- High load-carrying capacity
- Enables nondestructive dismantling, even after long use at high temperatures
- Coefficient of friction unchanged in the area of oiled bolts, even after several bolt retightening and loosening processes
- Good corrosion protection
- No intentional polytetrafluoroethylene (PTFE) or per- and polyfluoroalkyl substances (PFAS)

Composition

- Solid lubricants
- Mineral oil
- Thickener
- Powdered metal

Applications

Suitable for bolted joints that are subjected to high temperatures up to 650°C (1,202°F) and to corrosive effects – and that after assembling and the initial operation, have to be retightened or disconnected. In order to ensure constant pre-stressing forces, uniform and steady coefficients of friction of the lubricant are necessary. Used successfully for cylinder head bolts, nozzle head screws of plastic injection molding machines, bolted joints in the chemical industry, and also for the tension rings of centrifuges.

Description

MOLYKOTE® 1000 Paste is a lead- and nickel-free anti-seize paste used to reduce wear and optimize friction of threaded fasteners, or other metal-to-metal joints, enabling nondestructive dismantling, even after long exposure to high temperatures. It offers good corrosion protection, under high loads, over a wide temperature range.

How to use

If possible, clean the thread and the bolt with a wire brush. Spread an adequate amount of the paste on the thread, right up to its root to obtain a good seal. In order not to alter the properties, the paste must not be mixed with grease or oils.

Typical properties

Specification writers: These values are not intended for use in preparing specifications. Please contact your local MOLYKOTE® sales representative prior to writing specifications on this product.

Standard[1]	Test	Unit	Result
	Color		Brown
Penetration, density			
ISO 2137	Unworked penetration	mm/10	280-310
ISO 2811	Density at 20°C (68°F)	g/ml	1.26
Temperature			
	Service temperature range[2]	°C °F	-30 to 650 -22 to 1,202
Load-carrying capacity, wear protection, service life			
	Four-ball tester		
DIN 51 350 pt.4	Weld load	N	4,800
DIN 51 350 pt.5	Wear scar under 400 N load	mm	0.65
	Almen-Wieland machine		
	OK load	N	20,000
	Frictional force	N	2,600
Coefficient of friction			
	Screw test - µ thread[3]		0.13
	Screw test - µ head		0.08
	Initial break-away torque[4]	Nm	135
DIN 51 802	SKF-Emcor method		1

[1] ISO: International Standardization Organization. DIN: Deutsche Industrie Norm.
[2] Temperature resistance of solid lubricants.
[3] Coefficient of friction in bolted connection, M12, 8.8, on blackened surface.
[4] M 12, with starting torque Ma = 62 Nm and heat treatment at 540°C (1,004°F), 21 hr, bolt material: no. 1.7709.

To enable this product to be applied more quickly and cleanly to larger areas, it is advisable to use the spray can.

Handling precautions

PRODUCT SAFETY INFORMATION REQUIRED FOR SAFE USE IS NOT INCLUDED IN THIS DOCUMENT. BEFORE HANDLING, READ SAFETY DATA SHEETS AND CONTAINER LABELS FOR SAFE USE, PHYSICAL AND HEALTH HAZARD INFORMATION.

Usable life and storage

When stored at or below 20°C (68°F) in the original unopened containers, MOLYKOTE® 1000 Paste has a usable life of 60 months from the date of production.

Specifically for aerosol packaging, this product has a usable life of 24 months from the date of production when stored between 5°C and 35°C in the original unopened container. Because it is an aerosol, punctures should be avoided, and containers should be kept away from heat, sparks and open flame.

Packaging

This product is available in different standard container sizes as shown on **molykote.com**. Detailed container size information should be obtained from your nearest MOLYKOTE® sales office or MOLYKOTE® distributor.

Form No. 71-0218J-01 (01/24) AGP17374

SAFETY DATA SHEET

DDP SPECIALTY ELECTRONIC MATERIALS US 9, LLC

Product name: MOLYKOTE® 1000 Paste **Issue Date:** 11/09/2022

Print Date: 06/23/2023

DDP SPECIALTY ELECTRONIC MATERIALS US 9, LLC 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. IDENTIFICATION

Product name: MOLYKOTE® 1000 Paste

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

COMPANY IDENTIFICATION
DDP SPECIALTY ELECTRONIC MATERIALS
US 9, LLC
974 Centre Road
Wilmington DE 19805
UNITED STATES

Customer Information Number: 833-338-7668
SDSQuestion-NA@dupont.com

EMERGENCY TELEPHONE NUMBER
24-Hour Emergency Contact: 1-800-424-9300
Local Emergency Contact: 800-424-9300

2. HAZARDS IDENTIFICATION

Hazard classification
GHS classification in accordance with 29 CFR 1910.1200
Not a hazardous substance or mixture.

Other hazards
No data available
Further information
The values listed below represent the percentages of ingredients of unknown toxicity.
The following percentage of the mixture consists of ingredient(s) with unknown acute toxicity: 13 %

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical nature: Inorganic and organic compounds, in mineral oil

This product is a mixture.

Component	CASRN	Concentration
Calcium difluoride	7789-75-5	>= 18.0 - <= 26.0 %
Solvent dewaxed heavy paraffinic distillates	64742-65-0	<= 21.0 %
Distillates, petroleum, solvent-dewaxed light paraffinic	64742-56-9	<= 21.0 %
Graphite	7782-42-5	>= 9.0 - <= 13.0 %
Copper flakes	7440-50-8	>= 6.0 - <= 9.0 %
Silicon dioxide	7631-86-9	>= 1.9 - <= 2.5 %

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 effects occur, consult a physician.

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: If swallowed, seek medical attention. Do not induce vomiting unless directed to do so by medical personnel.

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: No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIREFIGHTING MEASURES

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

Unsuitable extinguishing media: None known.

Special hazards arising from the substance or mixture
Hazardous combustion products: Fluorine compounds Carbon oxides Metal oxides

Unusual Fire and Explosion Hazards: Exposure to combustion products may be a hazard to health.

Advice for firefighters
Fire Fighting Procedures: Collect contaminated fire extinguishing water separately. This must not be discharged into drains. Contain fire water run-off if possible. Fire water run-off, if not contained, may cause environmental damage.
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. 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: 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. 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: Wipe up or scrape up and contain for salvage or disposal. 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: Do not get on skin or clothing. Do not swallow. Avoid contact with eyes. Take care to prevent spills, waste and minimize release to the environment. Handle in accordance with good industrial hygiene and safety practice.
Use only with adequate ventilation. See Engineering measures under EXPOSURE CONTROLS/PERSONAL PROTECTION section.

Advice on general occupational hygiene
Handle in accordance with good industrial hygiene and safety practice. Use good personal hygiene. Do not consume or store food in the work area. Wash hands before smoking or eating.

Conditions for safe storage: Keep in properly labelled containers. Store in accordance with the particular national regulations.

Do not store with the following product types: Strong oxidizing agents.
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
Calcium difluoride	OSHA Z-1	TWA	2.5 mg/m3 , Fluorine
	Further information: (4): CAS number varies with compound		
	ACGIH	TWA	2.5 mg/m3 , Fluorine
	Further information: bone dam: Bone damage; fluorosis: Fluorosis; BEI: Substances for which there is a Biological Exposure Index or Indices (see BEI® section); A4: Not classifiable as a human carcinogen; varies: varies		
	CAL PEL	PEL	2.5 mg/m3 , Fluorine
	NIOSH REL	TWA	2.5 mg/m3 , Fluorine
	OSHA P0	TWA	2.5 mg/m3 , Fluorine
Solvent dewaxed heavy paraffinic distillates	ACGIH	TWA Inhalable particulate matter	5 mg/m3
	Further information: URT irr: Upper Respiratory Tract irritation; A4: Not classifiable as a human carcinogen		
	CAL PEL	PEL particulate	5 mg/m3
	Further information: (l): As sampled by method that does not collect vapor.		
	NIOSH REL	TWA Mist	5 mg/m3
	NIOSH REL	ST Mist	10 mg/m3
Distillates, petroleum, solvent-dewaxed light paraffinic	ACGIH	TWA Inhalable particulate matter	5 mg/m3
	Further information: URT irr: Upper Respiratory Tract irritation; A4: Not classifiable as a human carcinogen		
	CAL PEL	PEL particulate	5 mg/m3
	Further information: (l): As sampled by method that does not collect vapor.		
	NIOSH REL	TWA Mist	5 mg/m3
	NIOSH REL	ST Mist	10 mg/m3
Graphite	OSHA Z-1		See Further information
	Further information: (3): See table Z-3		
	OSHA Z-3	TWA Dust	15 Million particles per cubic foot
	Further information: a: Based on impinger samples counted by light-field techniques.; mppcf X 35.3 = million particles per cubic meter = particles per c.c		
	OSHA Z-1	TWA total dust	15 mg/m3
	OSHA Z-1	TWA respirable fraction	5 mg/m3
	ACGIH	TWA Respirable particulate matter	2 mg/m3
	Further information: pneumoconiosis: Pneumoconiosis		
	CAL PEL	PEL Total dust	10 mg/m3
	CAL PEL	PEL respirable dust fraction	5 mg/m3
	Further information: (n): The concentration and percentage of the particulate used for		

	this limit are determined from the fraction passing a size selector with the following characteristics: Aerodynamic Diameter in Micrometers (unit density sphere)..... Percent Passing Selector 0 ..... 100 1 ..... 97 2 ..... 91 3 ..... 74 4 ..... 50 5 ..... 30 6 ..... 17 7 ..... 9 8 ..... 5 10 1		
	CAL PEL	PEL Respirable dust	2.5 mg/m3
	NIOSH REL	TWA Respirable	2.5 mg/m3
	Further information: Also see specific listing for Graphite (synthetic).		
	OSHA P0	TWA Total dust	10 mg/m3
	OSHA P0	TWA respirable dust fraction	5 mg/m3
	OSHA P0	TWA respirable dust fraction	2.5 mg/m3
Silicon dioxide	Dow IHG	TWA Respirable fraction.	0.2 mg/m3

Biological occupational exposure limits

Components	CAS-No.	Control parameters	Biological specimen	Sampling time	Permissible concentration	Basis
Calcium difluoride	7789-75-5	Fluoride (Fluorine)	Urine	Prior to shift (16 hours after exposure ceases)	2 mg/l	ACGIH BEI

Exposure controls
Engineering controls: Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations.

Hygiene measures: Handle in accordance with good industrial hygiene and safety practice. Use good personal hygiene. Do not consume or store food in the work area. Wash hands before smoking or eating.

Individual protection measures
Eye/face protection: Use safety glasses (with side shields).
Skin protection
Hand protection: Use gloves chemically resistant to this material. 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: Use protective clothing chemically resistant to this material. Selection of specific items such as face shield, boots, apron, or full body suit will depend on the task.
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, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	
Physical state	paste
Color	brown
Odor	slight
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)	Not classified as a flammability hazard
Lower explosion limit	No data available
Upper explosion limit	No data available
Vapor Pressure	Not applicable
Relative Vapor Density (air = 1)	No data available
Relative Density (water = 1)	1.26
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	No data available

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.

Conditions to avoid: None known.

Incompatible materials: Oxidizing agents

Hazardous decomposition products: 1-Butene. Sodium.

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
Product test data not available. Refer to component data.

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:

Calcium difluoride

Acute oral toxicity
Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts.

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

Acute dermal toxicity
The dermal LD50 has not been determined.

Acute inhalation toxicity
LC50, Rat, male and female, 4 Hour, dust/mist, > 5.07 mg/l OECD Test Guideline 403 No deaths occurred at this concentration.

Skin corrosion/irritation
Brief contact is essentially nonirritating to skin.

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

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

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)
Observations in animals include:
May cause fluorosis of teeth and bones.

Carcinogenicity
Available data are inadequate to evaluate carcinogenicity.

Teratogenicity
Fluorides may cause mottling of teeth in children of mothers exposed excessively before or during pregnancy or during lactation.

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.

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

Solvent dewaxed heavy paraffinic distillates

Acute oral toxicity

Typical for this family of materials. LD50, Rat, > 5,000 mg/kg

Acute dermal toxicity
Typical for this family of materials. LD50, Rabbit, > 2,000 mg/kg

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

Skin corrosion/irritation
Brief contact may cause slight skin irritation with local redness.
Prolonged contact may cause moderate skin irritation with local redness.

Serious eye damage/eye irritation
May cause slight 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)
The substance or mixture is not classified as specific target organ toxicant, single exposure.

Specific Target Organ Systemic Toxicity (Repeated Exposure)
For this family of materials:
In animals, effects have been reported on the following organs:
Liver.

Carcinogenicity
For this family of materials: Did not cause cancer in animal skin painting studies.

Teratogenicity
Typical for this family of materials. Has been toxic to the fetus in laboratory animals at doses toxic to the mother.

Reproductive toxicity
Typical for this family of materials. Limited data in laboratory animals suggest that the material does not affect reproduction.

Mutagenicity
Typical for this family of materials. In vitro genetic toxicity studies were predominantly negative.

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

Distillates, petroleum, solvent-dewaxed light paraffinic

Acute oral toxicity
LD50, Rat, > 5,000 mg/kg OECD Test Guideline 401

Acute dermal toxicity
LD50, Rabbit, > 5,000 mg/kg OECD Test Guideline 402

Acute inhalation toxicity
Based on data from similar materials LC50, Rat, 4 Hour, dust/mist, > 5.53 mg/l OECD Test Guideline 403

Skin corrosion/irritation
Brief contact may cause slight skin irritation with local redness.

Serious eye damage/eye irritation
Essentially nonirritating to eyes.

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)
Available data are inadequate to determine single exposure specific target organ toxicity.

Specific Target Organ Systemic Toxicity (Repeated Exposure)
Based on information for a similar material:
In animals, effects have been reported on the following organs:
Lung.

Carcinogenicity
Did not cause cancer in laboratory animals.

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
Based on information for a similar material: In vitro genetic toxicity studies were negative. Animal genetic toxicity studies were negative.

Aspiration Hazard
Based on available information, aspiration hazard could not be determined.

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

Skin corrosion/irritation
Brief contact is essentially nonirritating to skin.

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

Copper flakes

Acute oral toxicity
LD50, Rat, 481 mg/kg OECD Test Guideline 423

Acute inhalation toxicity
LC50, Rat, 4 Hour, dust/mist, 0.733 mg/l

Skin corrosion/irritation
Brief contact is essentially nonirritating to skin.

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

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

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 additional significant adverse effects.
Information given is based on data obtained from similar substances.

Carcinogenicity

Animal testing did not show any carcinogenic effects.

Teratogenicity
Did not cause birth defects in laboratory animals.

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

Mutagenicity
Animal genetic toxicity studies were negative. This material was not mutagenic in an Ames bacterial assay.

Aspiration Hazard
No aspiration toxicity classification

Silicon dioxide

Acute oral toxicity
LD50, Rat, > 3,300 mg/kg

Acute dermal toxicity
LD50, Rabbit, > 5,000 mg/kg

Acute inhalation toxicity
Maximum attainable concentration. LC50, Rat, 4 Hour, dust/mist, > 2.08 mg/l No deaths occurred at this concentration.

Skin corrosion/irritation
Brief contact is essentially nonirritating to skin.

Serious eye damage/eye irritation
Solid or dust may cause irritation or corneal injury due to mechanical action.

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
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.

12. ECOLOGICAL INFORMATION

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

Toxicity

Calcium difluoride

Acute toxicity to fish
Not expected to be acutely toxic to aquatic organisms.
No toxicity at the limit of solubility
LC50, Oncorhynchus mykiss (rainbow trout), static test, 96 Hour, 105 - 698 mg/l

Acute toxicity to aquatic invertebrates
For similar material(s):
No toxicity at the limit of solubility
EC50, Daphnia magna (Water flea), 48 Hour, 53.4 - 98.5 mg/l

Acute toxicity to algae/aquatic plants
For similar material(s):
No toxicity at the limit of solubility
EC50, Scenedesmus capricornutum (fresh water algae), 96 Hour, 88.3 - 250 mg/l
For similar material(s):
No toxicity at the limit of solubility
NOEC, Scenedesmus capricornutum (fresh water algae), 96 Hour, 103 - 510 mg/l
For similar material(s):
No toxicity at the limit of solubility
EC50, Skeletonema costatum (marine diatom), 96 Hour, 166 mg/l

Solvent dewaxed heavy paraffinic distillates

Acute toxicity to fish
Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).
LL50, Pimephales promelas (fathead minnow), static test, 96 Hour, > 100 mg/l

Acute toxicity to aquatic invertebrates
EL50, Daphnia magna (Water flea), static test, 48 Hour, > 10,000 mg/l

Acute toxicity to algae/aquatic plants
NOEC, Pseudokirchneriella subcapitata (green algae), static test, 72 Hour, Growth rate, > 100 mg/l

Toxicity to bacteria
Based on data from similar materials
NOEC, 10 min, > 1.93 mg/l, DIN 38 412 Part 8

Chronic toxicity to aquatic invertebrates

Based on data from similar materials
NOEC, Daphnia magna (Water flea), 21 d, 10 mg/l

Distillates, petroleum, solvent-dewaxed light paraffinic

Acute toxicity to fish
Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).
Based on data from similar materials
LC50, Pimephales promelas (fathead minnow), 96 Hour, > 100 mg/l, OECD Test Guideline 203

Acute toxicity to aquatic invertebrates
Based on data from similar materials
EC50, Daphnia magna (Water flea), 48 Hour, > 10,000 mg/l, OECD Test Guideline 202

Acute toxicity to algae/aquatic plants
Based on data from similar materials
EC50, Pseudokirchneriella subcapitata (green algae), 72 Hour, > 100 mg/l, OECD Test Guideline 201

Toxicity to bacteria
Based on data from similar materials
NOEC, 10 min, > 1.93 mg/l, DIN 38 412 Part 8

Chronic toxicity to aquatic invertebrates
Based on data from similar materials
NOEC, Daphnia magna (Water flea), 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

Copper flakes

Acute toxicity to fish
LC50, Oncorhynchus mykiss (rainbow trout), 96 Hour, 0.068 mg/l

Acute toxicity to aquatic invertebrates
EC50, Daphnia magna (Water flea), 48 Hour, 0.034 mg/l, OECD Test Guideline 202

Acute toxicity to algae/aquatic plants

Information given is based on data obtained from similar substances.
EC50, Pseudokirchneriella subcapitata (green algae), 72 Hour, 0.03 mg/l, OECD Test Guideline 201
NOEC, Algae, 10 d, 0.022 mg/l, OECD Test Guideline 201

Chronic toxicity to fish
NOEC, Oncorhynchus mykiss (rainbow trout), 61 d, 0.024 mg/l

Chronic toxicity to aquatic invertebrates
NOEC, Daphnia magna (Water flea), 21 d, 0.0368 mg/l

Silicon dioxide

Acute toxicity to fish
Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).
LC50, Danio rerio (zebra fish), 96 Hour, 5,000 - 10,000 mg/l

Acute toxicity to aquatic invertebrates
EC50, Daphnia magna (Water flea), 24 Hour, > 1,000 mg/l

Acute toxicity to algae/aquatic plants
EC50, Pseudokirchneriella subcapitata (green algae), 72 Hour, Biomass, 440 mg/l

Persistence and degradability

Calcium difluoride
Biodegradability: Biodegradability is not applicable to inorganic substances.

Solvent dewaxed heavy paraffinic distillates
Biodegradability: Material is expected to biodegrade very slowly (in the environment). Fails to pass OECD/EEC tests for ready biodegradability.
10-day Window: Fail
Biodegradation: 2 %
Exposure time: 28 d
Method: OECD Test Guideline 301B

Distillates, petroleum, solvent-dewaxed light paraffinic
Biodegradability: Based on stringent OECD test guidelines, this material cannot be considered as readily biodegradable; however, these results do not necessarily mean that the material is not biodegradable under environmental conditions.
10-day Window: Fail
Biodegradation: 2 - 4 %
Exposure time: 28 d
Method: OECD Test Guideline 301B

Graphite
Biodegradability: Not applicable

Copper flakes
Biodegradability: Biodegradation is not applicable.

Silicon dioxide

Biodegradability: Biodegradation is not applicable.

Bioaccumulative potential

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

Solvent dewaxed heavy paraffinic distillates
Bioaccumulation: Bioconcentration potential is high (BCF > 3000 or Log Pow between 5 and 7).
Partition coefficient: n-octanol/water(log Pow): 3.9 - 6 Estimated.

Distillates, petroleum, solvent-dewaxed light paraffinic
Bioaccumulation: No relevant data found.

Graphite
Bioaccumulation: Not applicable Not applicable

Copper flakes
Bioaccumulation: Not applicable

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

Mobility in soil

Calcium difluoride
No relevant data found.

Solvent dewaxed heavy paraffinic distillates
No relevant data found.

Distillates, petroleum, solvent-dewaxed light paraffinic
No relevant data found.

Graphite
No relevant data found.

Silicon dioxide
No relevant data found.

13. DISPOSAL CONSIDERATIONS

Disposal methods: DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. AS YOUR SUPPLIER, WE HAVE NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE

INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information. FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Incinerator or other thermal destruction device. For additional information, refer to: Handling & Storage Information, MSDS Section 7 Stability & Reactivity Information, MSDS Section10 Regulatory Information, MSDS Section 15

Treatment and disposal methods of used packaging: Empty containers should be recycled or otherwise disposed of by an approved waste management facility. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. Do not re-use containers for any purpose.

14. TRANSPORT INFORMATION

DOT

Proper shipping name	Environmentally hazardous substance, solid, n.o.s.(Zinc, Copper metal powder)
UN number	UN 3077
Class	9
Packing group	III
Marine pollutant	Copper metal powder
Reportable Quantity	Zinc

Classification for SEA transport (IMO-IMDG):

Proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.(Zinc)
UN number	UN 3077
Class	9
Packing group	III
Marine pollutant	Zinc
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	Environmentally hazardous substance, solid, n.o.s.(Zinc)
UN number	UN 3077
Class	9
Packing group	III

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

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312
No SARA Hazards

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313
The following components are subject to reporting levels established by SARA Title III, Section 313:

Components	**CASRN**
Zinc powder - zinc dust (stabilized)	7440-66-6

California Prop. 65
WARNING: This product can expose you to chemicals including Silicon dioxide, which is/are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

United States TSCA Inventory (TSCA)
All components of this product are in compliance with the inventory listing requirements of the U.S. Toxic Substances Control Act (TSCA) Chemical Substance Inventory.

16. OTHER INFORMATION

Hazard Rating System
NFPA

Health	Flammability	Instability
0	1	0

HMIS

Health	Flammability	Physical Hazard
0/	1	0

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

Legend

ACGIH	USA. ACGIH Threshold Limit Values (TLV)
ACGIH BEI	ACGIH - Biological Exposure Indices (BEI)
CAL PEL	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
Dow IHG	Dow Industrial Hygiene Guideline
NIOSH REL	USA. NIOSH Recommended Exposure Limits
OSHA P0	USA. Table Z-1-A Limits for Air Contaminants (1989 vacated values)
OSHA Z-1	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
OSHA Z-3	USA. Occupational Exposure Limits (OSHA) - Table Z-3 Mineral Dusts

PEL	Permissible exposure limit
ST	STEL - 15-minute TWA exposure that should not be exceeded at any time during a workday
TWA	8-hour time weighted average

Full text of other abbreviations
AIIC - Australian Inventory of Industrial Chemicals; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; 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; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; 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; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; 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; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; 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.

DDP SPECIALTY ELECTRONIC MATERIALS US 9, LLC 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

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