TLA, TLF

Safety Data Sheet

US-SDS according to the federal final rule of hazard communication revised on 2024 (HazCom 2024)
Revision date: Feb.1 2026 Rev.3

SECTION 1: Identification

1.1. Identification

Product form : Mixture
Product name : TLA, TLF

1.2. Recommended use and restrictions on use

Use of the substance/mixture : Laminates for circuit boards

1.3. Supplier

AMMK Co., Ltd.
4F Yeoam B/D, 10, Hwangsaeul-ro 351beon-gil
Bundang-gu, Seongnam-si, Gyeonggi-do, Korea
T +82-31-704-1858

AGC Multi Material America Inc.
1420 W 12th Place
Tempe, AZ 85281, USA
T +1-480-967-5600

AGC Multi Material Singapore Pte. Ltd.
4 Gul Crescent
Jurong, Singapore 629520
T +65-6861-7117

1.4. Emergency telephone number

Emergency number :
AMMK Co., Ltd. : +82-31-704-1858 (9am - 5pm KST) M - F
AGC Multi Material America Inc. : +1-480-967-5600 (9am - 5pm MST) M - F
AGC Multi Material Singapore Pte. Ltd. : +65-6861-7117 (9am - 5pm SST) M - F

SECTION 2: Hazard(s) identification

2.1. Classification of the substance or mixture

GHS US classification

Not classified

2.2. GHS Label elements, including precautionary statements

GHS US labeling

No labeling applicable

2.3. Other hazards which do not result in classification

No additional information available

2.4. Unknown acute toxicity (GHS US)

Not applicable

SECTION 3: Composition/Information on ingredients

3.1. Substances

Not applicable

3.2. Mixtures

Name	Product identifier	Conc. (% w/w)
Poly(tetrafluoroethylene)	CAS-No.: 9002-84-0	10 – 70
Copper	CAS-No.: 7440-50-8	1 – 50
Silicon dioxide	CAS-No.: 60676-86-0	2 – 35
Glass, oxide, chemicals	CAS-No.: 65997-17-3	5 – 28

Name	Product identifier	Conc. (% w/w)
Titanium dioxide	CAS-No.: 13463-67-7	1 – 25
1,1,1,2,2,3,3-Heptafluoro-3-[(trifluoroethenyl)oxy]propane, tetrafluoroethene polymer	CAS-No.: 26655-00-5	1 – 10

The specific chemical\ component identities and/or the exact component percentages of this material may be withheld as trade secrets. This information is made available to health professionals, employees, and designated representatives in accordance with the applicable provisions of 29 CFR 1910.1200 (I)(1). Trace ingredients (if any) are present in < 1% concentration, (< 0.1% for potential carcinogens, mutagen, and reproductive toxicant, respiratory tract and skin sensitizers in addition to oral/ inhalation acute toxicant in category 1 and 2). None of the trace ingredients contribute significant additional hazards at the concentrations that may be present in this product. All pertinent hazard information has been provided in this document, per the requirements of the Federal Occupational Safety and Health Administration Standard (29 CFR 1910.1200), U.S. State equivalents.

SECTION 4: First-aid measures

4.1. Description of first aid measures

First-aid measures general : If you feel unwell, seek medical advice.

First-aid measures after inhalation : If fumes from heat or combustion are inhaled, move air to a clean location and get medical attention.

First-aid measures after skin contact : Cool skin rapidly with cold water after contact with molten polymer. Do not peel polymer from the skin. Thoroughly flush with plenty of water and soap or skin cleanser. Get medical attention if changes in appearance or pain occur. Get medical attention if burned.

First-aid measures after eye contact : Get medical attention as soon as possible. If eye irritation persists: Get medical advice/attention. Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses.

First-aid measures after ingestion : If swallowed, induce vomiting immediately as directed by medical personnel.

4.2. Most important symptoms and effects (acute and delayed)

Symptoms/effects after inhalation : None under normal conditions. Dust of the product, if present, may cause respiratory irritation after an excessive inhalation exposure.

Symptoms/effects after skin contact : None under normal conditions. Dust may cause irritation in skin folds or by contact in combination with tight clothing.

Symptoms/effects after eye contact : None under normal conditions. Dust from this product may cause eye irritation.

Symptoms/effects after ingestion : None under normal conditions.

4.3. Immediate medical attention and special treatment, if necessary

Treat symptomatically.

SECTION 5: Fire-fighting measures

5.1. Suitable (and unsuitable) extinguishing media

Suitable extinguishing media : Adapt extinguishing media to the environment for surrounding fires.

5.2. Specific hazards arising from the chemical

Fire hazard : No fire hazard.

Explosion hazard : No direct explosion hazard.

Hazardous decomposition products in case of fire : Toxic fumes may be released.

5.3. Special protective equipment and precautions for fire-fighters

Firefighting instructions : Fight fire from safe distance and protected location. Do not enter fire area without proper protective equipment, including respiratory protection.

Protection during firefighting : Do not attempt to take action without suitable protective equipment. Self-contained breathing apparatus. Complete protective clothing.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Notify authorities if product enters sewers or public waters. Absorb spillage to prevent material-damage.

6.1.1. For non-emergency personnel

Protective equipment : Wear recommended personal protective equipment.
Emergency procedures : Ventilate spillage area.

6.1.2. For emergency responders

Protective equipment : Do not attempt to take action without suitable protective equipment. For further information refer to section 8: "Exposure controls/personal protection".
Emergency procedures : Evacuate unnecessary personnel.

6.2. Environmental precautions

Avoid release to the environment.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up : Mechanically recover the product.
Other information : Dispose of materials or solid residues at an authorized site.

6.4. Reference to other sections

For further information refer to section 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Additional hazards when processed : Not expected to present a significant hazard under anticipated conditions of normal use.
Precautions for safe handling : Ensure good ventilation of the work station. Wear personal protective equipment.
Hygiene measures : Do not eat, drink or smoke when using this product. Always wash hands after handling the product.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Keep in a cool, well-ventilated place away from heat.
Storage conditions : Keep cool. Protect from sunlight.
Packaging materials : Store always product in container of same material as original container.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Australia

Copper (7440-50-8)	
Australia - Occupational Exposure Limits	
Local name	Copper
OES TWA	0.2 mg/m³ fume 1 mg/m³ dusts & mists (as Cu)
Regulatory reference	Workplace exposure standards for airborne contaminants (2024)

Titanium dioxide (13463-67-7)
Australia - Occupational Exposure Limits

Local name	Titanium dioxide
OES TWA	10 mg/m³
Remark (AU)	(a) This value is for inhalable dust containing no asbestos and < 1% crystalline silica.
Regulatory reference	Workplace exposure standards for airborne contaminants (2024)

Silica, vitreous (60676-86-0)	
Australia - Occupational Exposure Limits	
Local name	Silica, fused
OES TWA	0.05 mg/m³
Remark (AU)	See Silica - Crystalline
Regulatory reference	Workplace exposure standards for airborne contaminants (2024)

Canada

Poly(tetrafluoroethylene) (9002-84-0)	
Canada (Quebec) - Occupational Exposure Limits	
Local name	Polytetrafluoroethylene decomposition products
Notations and remarks	Determine quantitatively the decomposition products in the air and express the results as Fluorides
Regulatory reference	S-2.1, r. 13 - Regulation respecting occupational health and safety

Glass, oxide, chemicals (65997-17-3)	
Canada (Alberta) - Occupational Exposure Limits	
Local name	Synthetic Vitreous Fibres: Glass Fibres Continuous filament
OEL TWA	1 fibers/cm³ 5 mg/m³ Total
Notations and remarks	Occupational exposure limit is based on irritation effects and its adjustment to compensate for unusual work schedules is not required.
Regulatory reference	Alberta Regulation 87/2009 (Alberta Regulation 150/2020)
Canada (Quebec) - Occupational Exposure Limits	
Local name	Fibres-artificial vitreous mineral fibres - Fibrous glass, continuous filament
VEMP (OEL TWAEV)	1 fibers/cm³
Regulatory reference	S-2.1, r. 13 - Regulation respecting occupational health and safety
Canada (British Columbia) - Occupational Exposure Limits	
Local name	Synthetic Vitreous Fibres - Continuous filament glass fibres
OEL TWA	1 fibers/cm³ 5 mg/m³ Inhalable
Regulatory reference	OHS Guidelines Part 5: Chemical Agents and Biological Agents (WorkSafe BC)
Canada (Manitoba) - Occupational Exposure Limits	
Local name	Synthetic vitreus fibers - Continuous filament glass fibers
OEL TWA	5 mg/m³ (I - Inhalable particulate matter)

Glass, oxide, chemicals (65997-17-3)	
	1 fibers/cm³ (F - Respirable fibers)
Notations and remarks	TLV® Basis: URT irr. Notations: A4 (Not classifiable as a Human Carcinogen)
Regulatory reference	ACGIH
Canada (Newfoundland and Labrador) - Occupational Exposure Limits	
Local name	Synthetic vitreus fibers - Continuous filament glass fibers
OEL TWA	5 mg/m³ (I - Inhalable particulate matter)
	1 fibers/cm³ (F - Respirable fibers)
Notations and remarks	TLV® Basis: URT irr. Notations: A4 (Not classifiable as a Human Carcinogen)
Regulatory reference	ACGIH
Canada (Nova Scotia) - Occupational Exposure Limits	
Local name	Synthetic vitreus fibers - Continuous filament glass fibers
OEL TWA	5 mg/m³ (I - Inhalable particulate matter)
	1 fibers/cm³ (F - Respirable fibers)
Notations and remarks	TLV® Basis: URT irr. Notations: A4 (Not classifiable as a Human Carcinogen)
Regulatory reference	ACGIH
Canada (Ontario) - Occupational Exposure Limits	
Local name	Continuous filament glass fibres (Synthetic Vitreous Fibres (Man Made Mineral Fibres))
OEL TWAEV	5 mg/m³ (I - Inhalable fraction) 1 fiber/mL (F - Respirable fibres)
Regulatory reference	Ontario Occuational Exposure Limits under Regulation 833
Canada (Prince Edward Island) - Occupational Exposure Limits	
Local name	Synthetic vitreus fibers - Continuous filament glass fibers
OEL TWA	5 mg/m³ (I - Inhalable particulate matter)
	1 fibers/cm³ (F - Respirable fibers)
Notations and remarks	TLV® Basis: URT irr. Notations: A4 (Not classifiable as a Human Carcinogen)
Regulatory reference	ACGIH
USA - ACGIH - Occupational Exposure Limits	
Local name	Synthetic vitreus fibers - Continuous filament glass fibers
ACGIH OEL TWA	5 mg/m³ (I - Inhalable particulate matter)
	1 fibers/cm³ (F - Respirable fibers)
Remark (ACGIH)	TLV® Basis: URT irr. Notations: A4 (Not classifiable as a Human Carcinogen)
Regulatory reference	ACGIH 2021

Copper (7440-50-8)	
Canada (Alberta) - Occupational Exposure Limits	
Local name	Copper
OEL TWA	0.2 mg/m³ Fume 1 mg/m³ Dusts/mists, as Cu

Copper (7440-50-8)	
Regulatory reference	Alberta Regulation 191/2021
Canada (Quebec) - Occupational Exposure Limits	
Local name	Copper
VEMP (OEL TWAEV)	0.2 mg/m³ Fume (as Cu) 1 mg/m³ Dusts & mists (as Co)
Regulatory reference	S-2.1, r. 13 - Regulation respecting occupational health and safety
Canada (British Columbia) - Occupational Exposure Limits	
Local name	Copper, as Cu
OEL TWA	1 mg/m³ Dusts and mists 0.2 mg/m³ Fume
Regulatory reference	OHS Guidelines Part 5: Chemical Agents and Biological Agents (WorkSafe BC)
Canada (Manitoba) - Occupational Exposure Limits	
Local name	Copper, as Cu
OEL TWA	0.2 mg/m³ (Fume) 1 mg/m³ (Dusts and mists)
Notations and remarks	TLV® Basis: Irr; GI; metal fume fever
Regulatory reference	ACGIH 2025
Canada (New Brunswick) - Occupational Exposure Limits	
Local name	Copper Fume as Cu
OEL TWA	0.2 mg/m³
Notations and remarks	Irr; GI; metal fume fever
Canada (Newfoundland and Labrador) - Occupational Exposure Limits	
Local name	Copper, as Cu
OEL TWA	0.2 mg/m³ (Fume) 1 mg/m³ (Dusts and mists)
Notations and remarks	TLV® Basis: Irr; GI; metal fume fever
Regulatory reference	ACGIH 2025
Canada (Nova Scotia) - Occupational Exposure Limits	
Local name	Copper, as Cu
OEL TWA	0.2 mg/m³ (Fume) 1 mg/m³ (Dusts and mists)
Notations and remarks	TLV® Basis: Irr; GI; metal fume fever
Regulatory reference	ACGIH 2025
Canada (Nunavut) - Occupational Exposure Limits	
Local name	Copper, (as Cu)
OEL TWA	0.2 mg/m³ Fume 1 mg/m³ Dusts and mists
OEL STEL	0.6 mg/m³ Fume 3 mg/m³ Dusts and mists

Copper (7440-50-8)	
Regulatory reference	Occupational Health and Safety Regulations, Nu Reg 003-2016 (Amendment R-044-2021)
Canada (Northwest Territories) - Occupational Exposure Limits	
Local name	Copper, (as Cu)
OEL TWA	0.2 mg/m³ Fume 1 mg/m³ Dusts and mists
OEL STEL	0.6 mg/m³ Fume 3 mg/m³ Dusts and mists
Regulatory reference	Occupation Health and Safety Regulations R-039-2015 (R-090-2024)
Canada (Ontario) - Occupational Exposure Limits	
Local name	Copper - Fume
OEL TWAEV	0.2 mg/m³
Regulatory reference	Ontario Occuational Exposure Limits under Regulation 833
Canada (Prince Edward Island) - Occupational Exposure Limits	
Local name	Copper, as Cu
OEL TWA	0.2 mg/m³ (Fume) 1 mg/m³ (Dusts and mists)
Notations and remarks	TLV® Basis: Irr; GI; metal fume fever
Regulatory reference	ACGIH 2025
Canada (Saskatchewan) - Occupational Exposure Limits	
Local name	Copper, (as Cu)
OEL TWA	0.2 mg/m³ fume 1 mg/m³ dusts and mists
OEL STEL	0.6 mg/m³ fume 3 mg/m³ dusts and mists
Regulatory reference	The Occupational Health and Safety Regulations, 2020. Chapter S-15.1 Reg 10

Titanium dioxide (13463-67-7)	
Canada (Alberta) - Occupational Exposure Limits	
Local name	Titanium dioxide
OEL TWA	10 mg/m³
Notations and remarks	Occupational exposure limit is based on irritation effects and its adjustment to compensate for unusual work schedules is not required.
Regulatory reference	Alberta Regulation 191/2021
Canada (Quebec) - Occupational Exposure Limits	
Local name	Titanium dioxide
VEMP (OEL TWAEV)	10 mg/m³ Td
Notations and remarks	Note 1: The standard corresponds to dust containing no asbestos and the percentage in crystalline silica is less than 1%
Regulatory reference	S-2.1, r. 13 - Regulation respecting occupational health and safety

Titanium dioxide (13463-67-7)	
Canada (British Columbia) - Occupational Exposure Limits	
Local name	Titanium dioxide
OEL TWA	10 mg/m³ Total dust 3 mg/m³ Respirable fraction
Regulatory reference	OHS Guidelines Part 5: Chemical Agents and Biological Agents (WorkSafe BC)
Canada (Manitoba) - Occupational Exposure Limits	
Local name	Titanium dioxide
OEL TWA	0.2 mg/m³ (Nanoscale particles. R - Repirable particulate matter) 2.5 mg/m³ (Finescale particles. R - Repirable particulate matter)
Notations and remarks	TLV® Basis: LRT irr; pneumoconiosis.
Regulatory reference	ACGIH 2025
Canada (New Brunswick) - Occupational Exposure Limits	
Local name	Titanium dioxide
OEL TWA	10 mg/m³
Notations and remarks	LRT irr
Canada (Newfoundland and Labrador) - Occupational Exposure Limits	
Local name	Titanium dioxide
OEL TWA	0.2 mg/m³ (Nanoscale particles. R - Repirable particulate matter) 2.5 mg/m³ (Finescale particles. R - Repirable particulate matter)
Notations and remarks	TLV® Basis: LRT irr; pneumoconiosis.
Regulatory reference	ACGIH 2025
Canada (Nova Scotia) - Occupational Exposure Limits	
Local name	Titanium dioxide
OEL TWA	0.2 mg/m³ (Nanoscale particles. R - Repirable particulate matter) 2.5 mg/m³ (Finescale particles. R - Repirable particulate matter)
Notations and remarks	TLV® Basis: LRT irr; pneumoconiosis.
Regulatory reference	ACGIH 2025
Canada (Nunavut) - Occupational Exposure Limits	
Local name	Titanium dioxide
OEL TWA	10 mg/m³
OEL STEL	20 mg/m³
Regulatory reference	Occupational Health and Safety Regulations, Nu Reg 003-2016 (Amendment R-044-2021)
Canada (Northwest Territories) - Occupational Exposure Limits	
Local name	Titanium dioxide
OEL TWA	10 mg/m³
OEL STEL	20 mg/m³
Regulatory reference	Occupation Health and Safety Regulations R-039-2015 (R-090-2024)

Titanium dioxide (13463-67-7)	
Canada (Ontario) - Occupational Exposure Limits	
Local name	Titanium dioxide
OEL TWAEV	10 mg/m³
Regulatory reference	Ontario Occuational Exposure Limits under Regulation 833
Canada (Prince Edward Island) - Occupational Exposure Limits	
Local name	Titanium dioxide
OEL TWA	0.2 mg/m³ (Nanoscale particles. R - Repirable particulate matter) 2.5 mg/m³ (Finescale particles. R - Repirable particulate matter)
Notations and remarks	TLV® Basis: LRT irr; pneumoconiosis.
Regulatory reference	ACGIH 2025
Canada (Saskatchewan) - Occupational Exposure Limits	
Local name	Titanium dioxide
OEL TWA	10 mg/m³
OEL STEL	20 mg/m³
Regulatory reference	The Occupational Health and Safety Regulations, 2020. Chapter S-15.1 Reg 10

Silicon dioxide (60676-86-0)	
Canada (Quebec) - Occupational Exposure Limits	
Local name	Silica - Amorphous, fused
VEMP (OEL TWAEV)	0.1 mg/m³ Rd
Notations and remarks	Note 1: The standard corresponds to dust containing no asbestos and the percentage in crystalline silica is less than 1%
Regulatory reference	S-2.1, r. 13 - Regulation respecting occupational health and safety
Canada (Nunavut) - Occupational Exposure Limits	
Local name	Silica, fused
OEL TWA	0.1 mg/m³ (respirable fraction)
Regulatory reference	Occupational Health and Safety Regulations, Nu Reg 003-2016 (Amendment R-044-2021)
Canada (Northwest Territories) - Occupational Exposure Limits	
Local name	Silica, fused
OEL TWA	0.1 mg/m³ (respirable fraction)
Regulatory reference	Occupation Health and Safety Regulations R-039-2015 (R-090-2024)
Canada (Ontario) - Occupational Exposure Limits	
Local name	Silica fused
OEL TWAEV	0.1 mg/m³ (R - Respirable fraction)
Regulatory reference	Ontario Occuational Exposure Limits under Regulation 833
Canada (Saskatchewan) - Occupational Exposure Limits	
Local name	Silica Amorphous: Silica, fused
OEL TWA	0.1 mg/m³ (respirable fraction)

Silicon dioxide (60676-86-0)	
Regulatory reference	The Occupational Health and Safety Regulations, 2020. Chapter S-15.1 Reg 10

China & Hong Kong

Copper (7440-50-8)	
China - Occupational Exposure Limits	
Local name	铜（按Cu 计）# Copper, as Cu
OEL PC-TWA	1 mg/m³ 尘# dust 0.2 mg/m³ 烟# fume
Regulatory reference	GBZ 2.1-2019

Titanium dioxide (13463-67-7)	
China - Occupational Exposure Limits	
Local name	二氧化钛粉尘 # Titanium dioxide dust
OEL PC-TWA	8 mg/m³ 总尘
Regulatory reference	GBZ 2.1-2019

European Union

Poly(tetrafluoroethylene) (9002-84-0)	
Switzerland - Occupational Exposure Limits	
Local name	Polytétrafluoroéthylène [PTFE] / Polytetrafluorethylen [PTFE]
MAK (OEL TWA)	3 mg/m³ (a) / (a)
Regulatory reference	www.suva.ch, 01.01.2025

Glass, oxide, chemicals (65997-17-3)	
EU - Binding Occupational Exposure Limit (BOEL)	
Local name	Refractory ceramic fibres: Glass, oxide, chemicals
BOEL TWA	0.3 fibers/mL
Regulatory reference	DIRECTIVE (EU) 2019/130 (amending Directive 2004/37/EC)
USA - ACGIH - Occupational Exposure Limits	
Local name	Synthetic vitreus fibers - Continuous filament glass fibers
ACGIH OEL TWA	5 mg/m³ (I - Inhalable particulate matter)
	1 fibers/cm³ (F - Respirable fibers)
Remark (ACGIH)	TLV® Basis: URT irr. Notations: A4 (Not classifiable as a Human Carcinogen)
Regulatory reference	ACGIH 2021

Copper (7440-50-8)	
Austria - Occupational Exposure Limits	
Local name	Kupfer und seine Verbindungen
MAK (OEL TWA)	1 mg/m³ (als Cu berechnet, E) 0.1 mg/m³ (als Rauch, als Cu berechnet, A)
MAK (OEL STEL)	4 mg/m³ (als Cu berechnet, E, 4x 15(Miw) min) 0.4 mg/m³ (als Rauch, als Cu berechnet, A, 4x 15(Miw) min)
Regulatory reference	BGBl. II Nr. 156/2021
Belgium - Occupational Exposure Limits	
Local name	Cuivre (en Cu) # Koper (als Cu)
OEL TWA	0.2 mg/m³ (fumées) # (rook) 1 mg/m³ (poussières et brouillards de) # (stof en nevel)
Regulatory reference	Koninklijk besluit/Arrêté royal 16/11/2023
Bulgaria - Occupational Exposure Limits	
Local name	Мед
OEL TWA	0.1 mg/m³ (метални пари (като мед)) 1 mg/m³ (оксиди и неорганични съединения (като мед))
Regulatory reference	Наредба № 13 от 30.12.2003 г. за защита на работещите от рискове, свързани с експозиция на химични агенти при работа (изм. и доп. ДВ. бр. 28 от 2024 г., в сила от 05.04.2024 г.)
Croatia - Occupational Exposure Limits	
Local name	Bakar
GVI (OEL TWA)	0.2 mg/m³ dim (kao Cu) 1 mg/m³ prašina (kao Cu)
KGVI (OEL STEL)	2 mg/m³ prašina (kao Cu)
Regulatory reference	Pravilnik o zaštiti radnika od izloženosti opasnim kemikalijama na radu, graničnim vrijednostima izloženosti i biološkim graničnim vrijednostima (NN 148/2023)
Czech Republic - Occupational Exposure Limits	
Local name	Měď
PEL (OEL TWA)	1 mg/m³ (prach) (V - vdechovatelná frakce aerosolu) 0.1 mg/m³ (dýmy) (R - respirabilní frakce aerosolu)
NPK-P (OEL C)	2 mg/m³ (prach) (V - vdechovatelná frakce aerosolu) 0.2 mg/m³ (dýmy) (R - respirabilní frakce aerosolu)
Remark	V - vdechovatelná frakce aerosolu, R - respirabilní frakce aerosolu.
Regulatory reference	Nařízení vlády č. 361/2007 Sb. (Předpis 20/2025 Sb.)
Denmark - Occupational Exposure Limits	
Local name	Kobber
OEL TWA	1 mg/m³ pulver og støv 0.1 mg/m³ røg, beregnet som Cu
Regulatory reference	BEK nr 1619 af 19/12/2024
Estonia - Occupational Exposure Limits	
Local name	Vask ja anorgaanilised ühendid (arvutatud vasele)

Copper (7440-50-8)	
OEL TWA	1 mg/m³ kogu tolm 0.2 mg/m³ peentolm
Regulatory reference	Vabariigi Valitsuse 20. märtsi 2001. a määruse nr 105 (RT I, 02.04.2024, 13)
Finland - Occupational Exposure Limits	
Local name	Kupari, metalli
HTP (OEL TWA)	0.02 mg/m³ Cu, alveolijae
Regulatory reference	HTP-ARVOT 2025 (Sosiaali- ja terveysministeriö)
France - Occupational Exposure Limits	
Local name	Cuivre
VME (OEL TWA)	0.2 mg/m³ (fumées) 1 mg/m³ (poussières), en Cu
VLE (OEL C/STEL)	2 mg/m³ (poussières), en Cu
Remark	Valeurs recommandées/admises
Regulatory reference	Circulaire du Ministère du travail (réf.: INRS ED 6443, 2022; Outil65)
Germany - Occupational Exposure Limits (TRGS 900)	
Local name	Kupfer und seine Verbindungen
AGW (OEL TWA)	0.045 mg/m³ (A) 0.2 mg/m³ (E)
Peak exposure limitation factor	(A): 8(II);(E): 4(II)
Remark	AGS - Ausschuss für Gefahrstoffe; 10 - Der Arbeitsplatzgrenzwert bezieht sich auf den Elementgehalt des entsprechenden Metalls
Regulatory reference	TRGS900
Hungary - Occupational Exposure Limits	
Local name	RÉZ és vegyületei (Cu-re számítva)
AK (OEL TWA)	0.1 mg/m³ 0.01 mg/m³ füst, respirábilis frakció
CK (OEL STEL)	0.2 mg/m³
Remark	R (Azok az anyagok, amelyek egészségkárosító hatása RÖVID expozíció hatására jelentkezik)
Regulatory reference	5/2020. (II. 6.) ITM rendelet - A kémiai kóroki tényezők hatásának kitett munkavállalók egészségének és biztonságának védelméről
Ireland - Occupational Exposure Limits	
Local name	Copper (as Cu)
OEL TWA	0.2 mg/m³ Fume 1 mg/m³ Dusts and mists
Remark	Advisory OELV (Advisory Occupational Exposure Limit Values)
Regulatory reference	Chemical Agents Code of Practice 2024
Latvia - Occupational Exposure Limits	
Local name	Varš
OEL TWA	0.5 mg/m³

Copper (7440-50-8)	
OEL STEL	1 mg/m³
Regulatory reference	Ministru kabineta 2007. gada 15. maija noteikumiem Nr. 325 (Grozījumi Ministru kabineta 2024. gada 26. martā noteikumiem Nr. 191).
Netherlands - Occupational Exposure Limits	
Local name	Koper
TGG-8u (OEL TWA)	0.1 mg/m³ en anorganische koperverbindingen (inhaleerbaar)
Regulatory reference	Arbeidsomstandighedenregeling 2024
Poland - Occupational Exposure Limits	
Local name	Miedź i jej związki nieorganiczne
NDS (OEL TWA)	0.2 mg/m³ w przeliczeniu na Cu
Regulatory reference	Dz. U. 2024 poz. 1017 wraz z późn. zm.
Portugal - Occupational Exposure Limits	
Local name	Cobre
OEL TWA	0.2 mg/m³ Fumos, expressos em Cu 1 mg/m³ Poeiras e névoas, expressos em Cu
Regulatory reference	Norma Portuguesa NP 1796:2014
Romania - Occupational Exposure Limits	
Local name	Cupru
OEL TWA	0.5 mg/m³ (Pulberi)
OEL STEL	0.2 mg/m³ (Fumuri) 1.5 mg/m³ (Pulberi)
Regulatory reference	Hotărârea Guvernului nr. 1.218/2006 (Hotărârea nr. 179/2024)
Slovakia - Occupational Exposure Limits	
Local name	Meď a jej anorganické zlúčeniny (ako Cu)
NPHV (OEL TWA)	1 mg/m³ inhalovateľná frakcia 0.2 mg/m³ respirabilná frakcia a dymy
Regulatory reference	Nariadenie vlády č. 355/2006 Z. z. (122/2024 Z. z.)
Spain - Occupational Exposure Limits	
Local name	Cobre
VLA-ED (OEL TWA)	0.01 mg/m³ Fracción respirable
Remark	d (Véase UNE EN 481: Atmósferas en los puestos de trabajo. Definición de las fracciones por el tamaño de las partículas para la medición de aerosoles).
Regulatory reference	Límites de Exposición Profesional para Agentes Químicos en España 2025. INSHT
Sweden - Occupational Exposure Limits	
Local name	Koppar och oorg. föreningar
NGV (OEL TWA)	0.01 mg/m³ (respirabel fraktion som Cu)
Remark	25 (Med inhalerbar och respirabel fraktion menas de dammfraktioner som definieras i svensk standard SS-EN 481, Arbetsplatsluft – Partikelstorleksfraktioner för mätning av luftburna partiklar (utgåva 1, 1993). Med totaldamm menas de partiklar (aerosoler) som fastnar på ett filter i en totaldammprovtagare)

Copper (7440-50-8)	
Regulatory reference	Arbetsmiljöverkets föreskrifter och allmänna råd (AFS 2023:14) om gränsvärden för luftvägsexponering i arbetsmiljön
United Kingdom - Occupational Exposure Limits	
Local name	Copper
WEL TWA (OEL TWA)	0.2 mg/m³ fume (as Cu) 1 mg/m³ and compounds, dusts and mists (as Cu)
WEL STEL (OEL STEL)	2 mg/m³ and compounds, dusts and mists (as Cu)
Regulatory reference	EH40/2005 (Fourth edition, 2020). HSE
Switzerland - Occupational Exposure Limits	
Local name	Cuivre et ses composés inorganiques / Kupfer und seine anorganischen Verbindungen
MAK (OEL TWA)	0.1 mg/m³ (i) / (e)
KZGW (OEL STEL)	0.2 mg/m³ (i) / (e)
Critical toxicity	Poumons, Fimétal / Lunge, Metallrauch
Notation	SS_C / SS_C
Remark	NIOSH. Exprimé en Cu / NIOSH. Als Cu berechnet
Regulatory reference	www.suva.ch, 01.01.2025
USA - ACGIH - Occupational Exposure Limits	
Local name	Copper, as Cu
ACGIH OEL TWA	0.2 mg/m³ (Fume) 1 mg/m³ (Dusts and mists)
Remark (ACGIH)	TLV® Basis: Irr; GI; metal fume fever
Regulatory reference	ACGIH 2025

Titanium dioxide (13463-67-7)	
Austria - Occupational Exposure Limits	
Local name	Titandioxid (Alveolarstaub)
MAK (OEL TWA)	5 mg/m³ (A)
MAK (OEL STEL)	10 mg/m³ (A, 2x 60(Miw) min)
Regulatory reference	BGBl. II Nr. 156/2021
Belgium - Occupational Exposure Limits	
Local name	Titane (dioxyde de) # Titaandioxide
OEL TWA	10 mg/m³
Regulatory reference	Koninklijk besluit/Arrêté royal 16/11/2023
Bulgaria - Occupational Exposure Limits	
Local name	Титанов диоксид
OEL TWA	10 mg/m³ (респирабилен прах)
Regulatory reference	Наредба № 13 от 30.12.2003 г. за защита на работещите от рискове, свързани с експозиция на химични агенти при работа (изм. и доп. ДВ. бр. 28 от 2024 г., в сила от 05.04.2024 г.)

Titanium dioxide (13463-67-7)	
Croatia - Occupational Exposure Limits	
Local name	Titanov dioksid
GVI (OEL TWA)	10 mg/m³ U (ukupna prašina) 4 mg/m³ R (respirabilna prašina)
Regulatory reference	Pravilnik o zaštiti radnika od izloženosti opasnim kemikalijama na radu, graničnim vrijednostima izloženosti i biološkim graničnim vrijednostima (NN 148/2023)
Denmark - Occupational Exposure Limits	
Local name	Titandioxid
OEL TWA	6 mg/m³ beregnet som Ti
Regulatory reference	BEK nr 1619 af 19/12/2024
Estonia - Occupational Exposure Limits	
Local name	Titaanoksiid
OEL TWA	5 mg/m³
Regulatory reference	Vabariigi Valitsuse 20. märtsi 2001. a määruse nr 105 (RT I, 02.04.2024, 13)
France - Occupational Exposure Limits	
Local name	Titane (dioxyde de), en Ti (Dioxyde de titane)
VME (OEL TWA)	10 mg/m³
Regulatory reference	Circulaire du Ministère du travail (réf.: INRS ED 6443, 2022; Outil65)
Greece - Occupational Exposure Limits	
Local name	Τιτανίου διοξείδιο
OEL TWA	10 mg/m³ εισπν. 5 mg/m³ σναπν.
Regulatory reference	Π.Δ. 90/1999 - Προστασία της υγείας των εργαζομένων που εκτίθενται σε ορισμένους χημικούς παράγοντες κατά τη διάρκεια της εργασίας τους
Ireland - Occupational Exposure Limits	
Local name	Titanium dioxide
OEL TWA	10 mg/m³ total inhalable dust 4 mg/m³ respirable dust
Remark	Advisory OELV (Advisory Occupational Exposure Limit Values)
Regulatory reference	Chemical Agents Code of Practice 2024
Latvia - Occupational Exposure Limits	
Local name	Titāna dioksīds
OEL TWA	10 mg/m³
Regulatory reference	Ministru kabineta 2007. gada 15. maija noteikumiem Nr. 325 (Grozījumi Ministru kabineta 2024. gada 26. martā noteikumiem Nr. 191).
Lithuania - Occupational Exposure Limits	
Local name	Titano dioksidas
IPRV (OEL TWA)	5 mg/m³
Regulatory reference	LIETUVOS HIGIENOS NORMA HN 23:2011 (Nr. V-695/A1-272, 2018-06-12)

Titanium dioxide (13463-67-7)	
Poland - Occupational Exposure Limits	
Local name	Ditlenek tytanu
NDS (OEL TWA)	10 mg/m³ frakcja wdychalna
Remark	Frakcja wdychalna – frakcja aerozolu wnikająca przez nos i usta, która stwarza zagrożenie dla zdrowia po zdeponowaniu w drogach oddechowych. Równolegle oznacza się frakcję respirabilną krystalicznej krzemionki.
Regulatory reference	Dz. U. 2024 poz. 1017 wraz z późn. zm.
Portugal - Occupational Exposure Limits	
Local name	Dióxido de titânio
OEL TWA	10 mg/m³
Remark	A4 (Agente não classificável como carcinogénico no Homem)
Regulatory reference	Norma Portuguesa NP 1796:2014
Romania - Occupational Exposure Limits	
Local name	Dioxid de titan
OEL TWA	10 mg/m³
OEL STEL	15 mg/m³
Regulatory reference	Hotărârea Guvernului nr. 1.218/2006 (Hotărârea nr. 179/2024)
Slovakia - Occupational Exposure Limits	
Local name	Oxid titaničitý
NPHV (OEL TWA)	5 mg/m³
Regulatory reference	Nariadenie vlády č. 355/2006 Z. z. (122/2024 Z. z.)
Spain - Occupational Exposure Limits	
Local name	Dióxido de titanio
VLA-ED (OEL TWA)	10 mg/m³
Regulatory reference	Límites de Exposición Profesional para Agentes Químicos en España 2025. INSHT
Sweden - Occupational Exposure Limits	
Local name	Titandioxid
NGV (OEL TWA)	5 mg/m³ (totaldamm)
Remark	25 (Med inhalerbar och respirabel fraktion menas de dammfraktioner som definieras i svensk standard SS-EN 481, Arbetsplatsluft – Partikelstorleksfraktioner för mätning av luftburna partiklar (utgåva 1, 1993). Med totaldamm menas de partiklar (aerosoler) som fastnar på ett filter i en totaldammprovtagare)
Regulatory reference	Arbetsmiljöverkets föreskrifter och allmänna råd (AFS 2023:14) om gränsvärden för luftvägsexponering i arbetsmiljön
United Kingdom - Occupational Exposure Limits	
Local name	Titanium dioxide
WEL TWA (OEL TWA)	4 mg/m³ respirable 10 mg/m³ total inhalable
Regulatory reference	EH40/2005 (Fourth edition, 2020). HSE

Titanium dioxide (13463-67-7)	
Switzerland - Occupational Exposure Limits	
Local name	Dioxyde de titane / Titandioxid
MAK (OEL TWA)	3 mg/m³ (a) / (a)
Critical toxicity	VRI / UAW
Notation	SS_C / SS_C
Remark	NIOSH
Regulatory reference	www.suva.ch, 01.01.2025
USA - ACGIH - Occupational Exposure Limits	
Local name	Titanium dioxide
ACGIH OEL TWA	0.2 mg/m³ (Nanoscale particles. R - Repirable particulate matter) 2.5 mg/m³ (Finescale particles. R - Repirable particulate matter)
Remark (ACGIH)	TLV® Basis: LRT irr; pneumoconiosis.
Regulatory reference	ACGIH 2025

Silicon dioxide (60676-86-0)	
Austria - Occupational Exposure Limits	
Local name	Kieselsäuren, amorphe: Kieselglas
MAK (OEL TWA)	0.3 mg/m³ (A)
Regulatory reference	BGBl. II Nr. 156/2021
Belgium - Occupational Exposure Limits	
Local name	Silices amorphes: fumées (fraction alvéolaire) # Siliciumdioxide (amorf): rook (inadembare fractie)
OEL TWA	2 mg/m³
Regulatory reference	Koninklijk besluit/Arrêté royal 16/11/2023
Croatia - Occupational Exposure Limits	
Local name	Kvarcno staklo
GVI (OEL TWA)	0.08 mg/m³ R (respirabilna prašina)
Regulatory reference	Pravilnik o zaštiti radnika od izloženosti opasnim kemikalijama na radu, graničnim vrijednostima izloženosti i biološkim graničnim vrijednostima (NN 1/2021)
Denmark - Occupational Exposure Limits	
Local name	Silikatglas
OEL TWA	0.1 mg/m³ respirabel
Regulatory reference	BEK nr 1619 af 19/12/2024
Germany - Occupational Exposure Limits (TRGS 900)	
Local name	Kieselglas
AGW (OEL TWA)	0.3 mg/m³ (A)

Silicon dioxide (60676-86-0)	
Remark	DFG - Senatskommission zur Prüfung gesundheitsschädlicher Arbeitsstoffe der DFG (MAK-Kommission); Y - Ein Risiko der Fruchtschädigung braucht bei Einhaltung des Arbeitsplatzgrenzwertes und des biologischen Grenzwertes (BGW) nicht befürchtet zu werden
Regulatory reference	TRGS900
Ireland - Occupational Exposure Limits	
Local name	Silica, fused respirable dust
OEL TWA	0.08 mg/m³
Remark	Advisory OELV (Advisory Occupational Exposure Limit Values)
Regulatory reference	Chemical Agents Code of Practice 2024
Poland - Occupational Exposure Limits	
Local name	Krzemionka bezpostaciowa i syntetyczna: krzemionka stopiona (szkło kwarcowe)
NDS (OEL TWA)	2 mg/m³ frakcja wdychalna 1 mg/m³ frakcja respirabilna
Remark	Frakcja wdychalna – frakcja aerozolu wnikająca przez nos i usta, która stwarza zagrożenie dla zdrowia po zdeponowaniu w drogach oddechowych. Frakcja respirabilna – frakcja aerozolu wnikająca do dróg oddechowych, która stwarza zagrożenie dla zdrowia po zdeponowaniu w obszarze wymiany gazowej.
Regulatory reference	Dz. U. 2024 poz. 1017 wraz z późn. zm.
Slovenia - Occupational Exposure Limits	
Local name	kremenčevo steklo
OEL TWA	0.3 mg/m³
Remark	Y (Snovi, pri katerih ni nevarnosti za zarodek ob upoštevanju mejnih vrednosti in bat vrednosti)
Regulatory reference	Uradni list RS, št. 72/2021 z dne 11.5.2021
United Kingdom - Occupational Exposure Limits	
Local name	Silica, fused
WEL TWA (OEL TWA)	0.08 mg/m³ respirable dust
Regulatory reference	EH40/2005 (Fourth edition, 2020). HSE
Switzerland - Occupational Exposure Limits	
Local name	silice fondue / Kieselgut
MAK (OEL TWA)	0.3 mg/m³ (a) / (a)
Critical toxicity	Fibpulm / Lungenfibrose
Notation	SS_C / SS_C
Regulatory reference	www.suva.ch, 01.01.2025

India

Copper (7440-50-8)	
India - Occupational Exposure Limits	
Local name	Copper

PEL (OEL TWA)	0.2 mg/m³ Fume
Regulatory reference	Factories Act 1948 [Act No. 63 of 1948] As amended by the Factories (Amendment) Act, 1987. The second schedule "Permissible levels of certain chemical substances in work environment"

Silica, vitreous (60676-86-0)	
India - Occupational Exposure Limits	
Local name	Silica, SiO2 - Crystalline - Silica fused
Remark (IN)	In terms of dust count: 10600/ (% quartz + 10) mppcm, in terms of respirable dust: 10/ (% respirable quartz + 2) mg/m3, in terms of total dust: 30/(% quartz + 3) mg/m3
Regulatory reference	Factories Act 1948 [Act No. 63 of 1948] As amended by the Factories (Amendment) Act, 1987. The second schedule "Permissible levels of certain chemical substances in work environment"

Japan

Glass, oxide, chemicals (65997-17-3)	
Japan - Occupational Exposure Limits (JSOH)	
Local name	ガラス # glass, oxide, chemicals
JSOH OEL	0.01 mg/m³Ag として 0.05 mg/m³Cd として 0.05 mg/m³Co として 0.5 mg/m³Cr として 0.02 mg/m³ 吸入性粉塵、Mn として、有機マンガン化合物を除く 0.1 mg/m³ 総粉塵、Mn として、有機マンガン化合物を除く 0.03 mg/m³Pb として、アルキル鉛化合物を除く 0.1 mg/m³Sb として、スチビンを除く 0.1 mg/m³Se として、セレン化水素、六フッ素化セレンを除く
Regulatory reference	JCDB の調査による

Titanium dioxide (13463-67-7)	
Japan - Occupational Exposure Limits (JSOH)	
Local name	二酸化チタン # Titanium dioxide
JSOH OEL	2 mg/m³ 総粉塵 1.5 mg/m³ 吸入性粉塵 0.3 mg/m³ ナノ粒子
Regulatory reference	許容濃度等の勧告（2023 年度）産衛誌 65 巻

Korea

Copper (7440-50-8)	
Korea - Occupational Exposure Limits	
Local name	구리 # Copper

ISHA OEL TWA	1 mg/m³ (분진 및 미스트) # (Dust & mist, as Cu) 0.1 mg/m³ (흄) # (Fume)
ISHA OEL STEL	2 mg/m³ (분진 및 미스트) # (Dust & mist, as Cu)
Regulatory reference	고용노동부고시 제2020-48호 # MOEL Public Notice. No. 2020-48

Titanium dioxide (13463-67-7)	
Korea - Occupational Exposure Limits	
Local name	이산화티타늄 # Titanium dioxide
ISHA OEL TWA	10 mg/m³
Regulatory reference	고용노동부고시 제2020-48호 # MOEL Public Notice. No. 2020-48

Silica, vitreous (60676-86-0)	
Korea - Occupational Exposure Limits	
Local name	산화규소(비결정체 규소, 용융된) # Silica (Amorphous silica, fused)
ISHA OEL TWA	0.1 mg/m³ 호흡성 # (Respirable fraction)
Regulatory reference	고용노동부고시 제2020-48호 # MOEL Public Notice. No. 2020-48

Singapore

Copper (7440-50-8)	
Singapore - Occupational Exposure Limits	
Local name	Copper
PEL (OEL TWA)	0.2 mg/m³ Fume 1 mg/m³ Dusts and mists, as Cu
Regulatory reference	WSH Regulations 2014

Taiwan

Copper (7440-50-8)	
Taiwan - Occupational Exposure Limits	
Local name	銅# Copper
OEL TWA	0.2 mg/m³ 薰煙# fume 1 mg/m³ 粉塵和霧滴（以銅計）# dusts and mists (as Cu)
Regulatory reference	勞工作業場所容許暴露標準 (2018.03.14 修正) # Standards of Permissible Exposure Limits of Airborne Hazardous Substances in Workplace (2018.03.14 Modified)

Titanium dioxide (13463-67-7)	
Taiwan - Occupational Exposure Limits	
Local name	二氧化鈦 # Titanium dioxide

OEL TWA	10 mg/m³
Regulatory reference	勞工作業場所容許暴露標準 (2018.03.14 修正) # Standards of Permissible Exposure Limits of Airborne Hazardous Substances in Workplace (2018.03.14 Modified)

United States

TLA, TLF	
No additional information available	

Poly(tetrafluoroethylene) (9002-84-0)	
No additional information available	

Glass, oxide, chemicals (65997-17-3)	
No additional information available	
USA - ACGIH - Occupational Exposure Limits	
Local name	Synthetic vitreus fibers - Continuous filament glass fibers
ACGIH OEL TWA	5 mg/m³ (I - Inhalable particulate matter)
	1 fibers/cm³ (F - Respirable fibers)
Remark (ACGIH)	TLV® Basis: URT irr. Notations: A4 (Not classifiable as a Human Carcinogen)
Regulatory reference	ACGIH 2021

Copper (7440-50-8)	
No additional information available	
USA - ACGIH - Occupational Exposure Limits	
Local name	Copper, as Cu
ACGIH OEL TWA	0.2 mg/m³ (Fume) 1 mg/m³ (Dusts and mists)
Remark (ACGIH)	TLV® Basis: Irr; GI; metal fume fever
Regulatory reference	ACGIH 2025
USA - OSHA - Occupational Exposure Limits	
Local name	Copper
OSHA PEL TWA	0.1 mg/m³ (Fume (as Cu)) 1 mg/m³ (Dusts and mists (as Cu))
Regulatory reference (US-OSHA)	OSHA Annotated Table Z-1

1,1,1,2,2,3,3-Heptafluoro-3-[(trifluoroethenyl)oxy]propane, tetrafluoroethene polymer (26655-00-5)	
No additional information available	

Silicon dioxide (60676-86-0)	
No additional information available	
USA - OSHA - Occupational Exposure Limits	
Local name	Silica, fused, respirable dust
OSHA PEL TWA	20 mppcf
Remark (OSHA)	Table Z-3. For OSHA PEL (TWA): Use formula: (80 mg/m3 / (%SiO2)) for mg/m3. CAS No. source: eCFR Table Z-1.

Silicon dioxide (60676-86-0)	
Regulatory reference (US-OSHA)	OSHA Annotated Table Z-3 Mineral Dusts

Titanium dioxide (13463-67-7)	
No additional information available	
USA - ACGIH - Occupational Exposure Limits	
Local name	Titanium dioxide
ACGIH OEL TWA	0.2 mg/m³ (Nanoscale particles. R - Repirable particulate matter) 2.5 mg/m³ (Finescale particles. R - Repirable particulate matter)
Remark (ACGIH)	TLV® Basis: LRT irr; pneumoconiosis.
Regulatory reference	ACGIH 2025
USA - OSHA - Occupational Exposure Limits	
Local name	Titanium dioxide (Total dust)
OSHA PEL TWA	15 mg/m³
Regulatory reference (US-OSHA)	OSHA Annotated Table Z-1

8.2. Appropriate engineering controls

Appropriate engineering controls : Ensure good ventilation of the work station.
Environmental exposure controls : Avoid release to the environment.

8.3. Individual protection measures/Personal protective equipment

Personal protective equipment:
Wear recommended personal protective equipment.

Hand protection:
Protective gloves

Eye protection:
Safety glasses

Skin and body protection:
Wear suitable protective clothing

Respiratory protection:
In case of insufficient ventilation, wear suitable respiratory equipment

Personal protective equipment symbol(s):

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Solid
Color : copper brown
Odor : odorless
Odor threshold : No data available

pH	:	No data available
Melting point	:	320 – 340 °C
Freezing point	:	Not applicable
Boiling point	:	No data available
Flash point	:	Not applicable
Relative evaporation rate (butyl acetate=1)	:	No data available
Flammability	:	Non flammable.
Vapor pressure	:	No data available
Relative vapor density at 20°C	:	No data available
Relative density	:	2.33
Solubility	:	Insoluble.
Partition coefficient n-octanol/water (Log Pow)	:	No data available
Auto-ignition temperature	:	520 °C
Decomposition temperature	:	470 °C
Viscosity, kinematic	:	Not applicable
Viscosity, dynamic	:	No data available
Explosion limits	:	Not applicable
Explosive properties	:	Not classified.
Oxidizing properties	:	Not oxidising.

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

The product is non-reactive under normal conditions of use, storage and transport.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

No dangerous reactions known under normal conditions of use.

10.4. Conditions to avoid

Heat. At high temperature may liberate toxic gases.

10.5. Incompatible materials

Finely divided aluminum. Powdered metals. Strong oxidizers. Acids. Acetylene.

10.6. Hazardous decomposition products

Temperature levels and components that may start to be generated by pyrolysis: Fluorinated hydrocarbons, carbonyl fluoride and hydrogen fluoride 400 ℃＝750℉ or higher.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity (oral)	:	Not classified
Acute toxicity (dermal)	:	Not classified
Acute toxicity (inhalation)	:	Not classified

Glass, oxide, chemicals (65997-17-3)	
LD50 oral rat	> 2000 mg/kg body weight Animal: rat, Guideline: OECD Guideline 423 (Acute Oral toxicity - Acute Toxic Class Method)

Copper (7440-50-8)	
LD50 dermal rat	> 2000 mg/kg body weight Animal: rat, Guideline: OECD Guideline 402 (Acute Dermal Toxicity), Guideline: EU Method B.3 (Acute Toxicity (Dermal)), Guideline: EPA OTS 798.1100 (Acute Dermal Toxicity), Guideline: other:
LC50 Inhalation - Rat	> 5.11 mg/l air Animal: rat, Guideline: OECD Guideline 436 (Acute Inhalation Toxicity: Acute Toxic Class Method)

1,1,1,2,2,3,3-Heptafluoro-3-[(trifluoroethenyl)oxy]propane, tetrafluoroethene polymer (26655-00-5)	
LD50 oral rat	> 11000 mg/kg

Silicon dioxide (60676-86-0)	
LD50 dermal rabbit	> 5000 mg/kg body weight Animal: rabbit
LC50 Inhalation - Rat	> 2.08 mg/l air Animal: rat

Titanium dioxide (13463-67-7)	
LD50 oral rat	> 5000 mg/kg body weight Animal: rat, Animal sex: female, Guideline: OECD Guideline 425 (Acute Oral Toxicity: Up-and-Down Procedure), Guideline: EPA OPPTS 870.1100 (Acute Oral Toxicity)

Skin corrosion/irritation : Not classified
Serious eye damage/irritation : Not classified
Respiratory or skin sensitization : Not classified
Germ cell mutagenicity : Not classified
Carcinogenicity : Not classified.

Poly(tetrafluoroethylene) (9002-84-0)	
IARC group	3 - Not classifiable

Reproductive toxicity : Not classified

Silicon dioxide (60676-86-0)	
NOAEL (animal/male, F0/P)	5000 mg/kg body weight Animal: rat, Animal sex: male, Guideline: other:

STOT-single exposure : Not classified
STOT-repeated exposure : Not classified

Silicon dioxide (60676-86-0)	
NOAEL (oral,rat,90 days)	> 5000 mg/kg body weight Animal: rat, Animal sex: male

Aspiration hazard : Not classified
Viscosity, kinematic : Not applicable
Symptoms/effects after inhalation : None under normal conditions. Dust of the product, if present, may cause respiratory irritation after an excessive inhalation exposure.
Symptoms/effects after skin contact : None under normal conditions. Dust may cause irritation in skin folds or by contact in combination with tight clothing.
Symptoms/effects after eye contact : None under normal conditions. Dust from this product may cause eye irritation.
Symptoms/effects after ingestion : None under normal conditions.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : The product is not considered harmful to aquatic organisms or to cause long-term adverse effects in the environment.

Titanium dioxide (13463-67-7)	
LC50 - Fish [1]	> 100 mg/l

Titanium dioxide (13463-67-7)	
EC50 - Other aquatic organisms [1]	> 100 mg/l Test organisms (species):
LOEC (chronic)	5 mg/l Test organisms (species): Daphnia magna Duration: '21 d'

12.2. Persistence and degradability

No additional information available

12.3. Bioaccumulative potential

No additional information available

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Disposal methods

Regional waste regulation : Disposal must be done according to official regulations.
Waste treatment methods : Dispose of contents/container in accordance with licensed collector's sorting instructions.
Sewage disposal recommendations : Disposal must be done according to official regulations.
Product/Packaging disposal recommendations : Comply with applicable regulations for solid waste disposal. Disposal must be done according to official regulations.
Additional information : Do not re-use empty containers.

SECTION 14: Transport information

In accordance with DOT / IMDG / IATA

14.1. UN number

Not regulated for transport

14.2. UN proper shipping name

Proper Shipping Name (DOT) : Not applicable
Proper Shipping Name (IMDG) : Not applicable
Proper Shipping Name (IATA) : Not applicable

14.3. Transport hazard class(es)

DOT
Transport hazard class(es) (DOT) : Not applicable

IMDG
Transport hazard class(es) (IMDG) : Not applicable

IATA
Transport hazard class(es) (IATA) : Not applicable

14.4. Packing group

Packing group (DOT) : Not applicable
Packing group (IMDG) : Not applicable
Packing group (IATA) : Not applicable

14.5. Environmental hazards

Other information : No supplementary information available.

14.6. Special precautions for user

DOT
No data available

IMDG
No data available

IATA
No data available

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable

SECTION 15: Regulatory information

15.1. US Federal regulations

All components of this product are present and listed as Active on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory

This product or mixture is not known to contain a toxic chemical or chemicals in excess of the applicable de minimis concentration as specified in 40 CFR §372.38(a) subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Copper (7440-50-8)	
CERCLA RQ	5000 lb

15.2. International regulations

Australia

Australian Industrial Chemicals Introduction Scheme (AICIS)
Australian Inventory of Industrial Chemicals (AICIS introductions Inventory) status: All the chemicals contained in this product are listed.

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
No additional information is available.

Australian Pesticides and Veterinary Medicines Authority (APVMA)
No additional information is available.

Canada

Poly(tetrafluoroethylene) (9002-84-0)
Listed on the Canadian DSL (Domestic Substances List)

Glass, oxide, chemicals (65997-17-3)
Listed on the Canadian DSL (Domestic Substances List)

Copper (7440-50-8)
Listed on the Canadian DSL (Domestic Substances List)

1,1,1,2,2,3,3-Heptafluoro-3-[(trifluoroethenyl)oxy]propane, tetrafluoroethene polymer (26655-00-5)
Listed on the Canadian DSL (Domestic Substances List)

Titanium dioxide (13463-67-7)
Listed on the Canadian DSL (Domestic Substances List)

Silicon dioxide (60676-86-0)
Listed on the Canadian DSL (Domestic Substances List)

China & Hong Kong

New Chemical Substance Environmental Management Registration Measures (MEE Order 12 of 2020)	
Inventory of Existing Chemical Substances in China (IECSC)	Contains listed substance(s) Polytetrafluoroethylene resin (CAS-No. 9002-84-0) Glass, oxide, chemicals (CAS-No. 65997-17-3) Copper (CAS-No. 7440-50-8) Propane, 1,1,1,2,2,3,3-heptafluoro-3- [(trifluoro ethenyl) oxy]-, polymer with tetrafluoroethene (CAS-No. 26655-00-5) Silica, vitreous (CAS-No. 60676-86-0) Titanium oxide (CAS-No. 13463-67-7)
Law of the People's Republic of China on the Prevention and Control of Occupational Diseases	
Catalogue for Classification of Hazardous Factors of Occupational Diseases	Contains listed substance(s) Glass wool dust (CAS-No. 65997-17-3) Titanium dioxide dust (CAS-No. 13463-67-7)
Regulations on the Safe Management of Hazardous Chemicals (Decree 591 of the State Council)	
Catalogue of Hazardous Chemicals (2015)	Contains Hazardous Chemical(s) Copper (CAS-No. 7440-50-8) Titanium dioxide (CAS-No. 13463-67-7) Considered as Hazardous Chemical(s)

European Union

EU-Regulations

Contains no substance(s) listed on REACH Annex XVII (Restriction Conditions)
Contains no substance(s) listed on the REACH Candidate List
Contains no substance(s) listed on REACH Annex XIV (Authorisation List)
Contains no substance(s) listed on the PIC list (Regulation EU 649/2012 concerning the export and import of hazardous chemicals)
Contains no substance(s) listed on the POP list (Regulation EU 2019/1021 on persistent organic pollutants)
Contains no substance(s) listed on the Ozone Depletion list (Regulation EU 2024/590 on substances that deplete the ozone layer)
Contains no substance(s) listed on the Explosives Precursors list (Regulation EU 2019/1148 on the marketing and use of explosives precursors)
Contains no substance(s) listed on the Drug Precursors list (Regulation EC 273/2004 on the manufacture and the placing on market of certain substances used in the illicit manufacture of narcotic drugs and psychotropic substances)

National regulations

Austria

Ordinance on Flammable Liquids (VbF) : Auto detect

Germany

Employment restrictions	:	Observe restrictions according Act on the Protection of Working Mothers (MuSchG) Observe restrictions according Act on the Protection of Young People in Employment (JArbSchG)
Water hazard class (WGK)	:	WGK 1, Slightly hazardous to water (Classification according to AwSV, Annex 1)
Override matching entry (12. BImSchV)	:	Is not subject to the Major Accidents Ordinance (12. BImSchV)

Netherlands

SZW-lijst van kankerverwekkende stoffen	:	Glass, oxide, chemicals,Silicon dioxide are listed
SZW-lijst van mutagene stoffen	:	Glass, oxide, chemicals,Silicon dioxide are listed
SZW-lijst van reprotoxische stoffen – Borstvoeding	:	None of the components are listed
SZW-lijst van reprotoxische stoffen – Vruchtbaarheid	:	None of the components are listed
SZW-lijst van reprotoxische stoffen – Ontwikkeling	:	None of the components are listed

Switzerland

Storage class (LK)	:	NG - Non-hazardous

India
No additional information available.

Japan

Industrial Safety and Health Law	Dangerous or Harmful Substances for Labelling of Chemical Name etc. (Act Art.57 Para.1, Enforcement Order, Art.18 Item 1 and 2, Appended Table No.9) Copper and its compounds Crystalline silica Titanium (IV) oxide 【After amendment of April 2025】
	Dangerous or Harmful Substances for Labelling of Chemical Name etc. (Act Art.57 Para.1, Enforcement Order, Art.18 Item 1 and 3, Appended Table No.9) Copper and its compounds 【After amendment of April 2026
	Dangerous or Harmful Substances for Labelling of Chemical Name etc. (Act Art.57 Para.1, Enforcement Order, Art.18 Item 1 and 3, Appended Table No.9) Copper and its compounds
	Dangerous or Harmful Substances for Notification of Chemical Name etc. on SDS (Act, Art.57-2, Enforcement Order, Art.18-2 Item 1 and 2, Appended Table 9) Copper and its compounds (Ordinance number: 379) (30 ~ 40%) Crystalline silica (Ordinance number: 165-2) (under 5%) Titanium (IV) oxide (Ordinance number: 191) (under 5%) 【After amendment of April 2025】
	Dangerous or Harmful Substances for Notification of Chemical Name etc. on SDS (Act, Art.57-2 Para.1, Enforcement Order, Art.18-2 Item 1 and 3, Appended Table 9) Copper and its compounds (30 ~ 40%) 【After amendment of April 2026】
	Dangerous or Harmful Substances for Notification of Chemical Name etc. on SDS (Act, Art.57-2 Para.1, Enforcement Order, Art.18-2 Item 1 and 3, Appended Table 9) Copper and its compounds (30 ~ 40%) 【After amendment of April 2025】
	Chemical substances that damage the skin, etc. Harmful substances that cause skin irritation (Ordinance on Industrial Safety and Health, Article 594-2, Para.1, list of substances applicable to No. 0704 Item 1, 5 based on July 4, 2023) Copper
	Dangerous or Harmful Substances for Labelling of Chemical Name etc. (Act Art.57 Para.1, Enforcement Order, Art.18 Item 2 to 3, Ordinance on Industrial Safety and Health, Art.30 Appended Table No.2) Crystalline silica 【After amendment of April 2026】

	Dangerous or Harmful Substances for Labelling of Chemical Name etc. (Act Art.57 Para.1, Enforcement Order, Art.18 Item 2 to 3, Ordinance on Industrial Safety and Health, Art.30 Appended Table No.2) Crystalline silica
	Dangerous or Harmful Substances for Notification of Chemical Name etc. on SDS (Act, Art.57-2 Para.1, Enforcement Order, Art.18-2 Item 2 to 3, Ordinance on Industrial Safety and Health, Art.34-2 Appended Table No.2) Crystalline silica (under 5%) 【After amendment of April 2026】
	Dangerous or Harmful Substances for Notification of Chemical Name etc. on SDS (Act, Art.57-2 Para.1, Enforcement Order, Art.18-2 Item 2 to 3, Ordinance on Industrial Safety and Health, Art.34-2 Appended Table No.2) Crystalline silica (under 5%)
Water Pollution Prevention Law	Designated Materials (Article 2, Paragraph 4 of the Law, Article 3-3 of the Enforcement Order) Copper and its compounds Living Environment Pollution Items (Act, Art.2, Enforcement Oder, Art.3, Ministerial Ordinance to Provide for Effluent Standards, Art.1, Appended Table 2) Copper content
Air Pollution Control Law	Possible Hazardous Air Pollutants (Central Environment Council Report 9) Copper and its compounds
Waterworks Law	Hazardous substances (Act, Art. 4, Para 2), Standard for water quality (Ministerial Ordinance No.101of 2003,) Copper and its compounds
Sewerage Law	Substances for Water Quality Standard (Act, Art.12-2, Para.2, Enforcement Order Art.9-4) Copper and its compounds
Pneumoconiosis Law	Dusty Works, Act, Art.2, Ordinance for Enforcement, Art.2, Appended Table Silica Titanium oxide
Law Relating to Prevention of Marine Pollution and Maritime Disasters	Harmful Liquid Substances (Group Z), (Enforcement Order, Art. Appended Table 1) Titanium oxide

Korea

Occupational Safety and Health Act		
Threshold Limit Values Chemicals	Applicable	7440-50-8: Copper 60676-86-0: Silica (Amorphous silica, fused) 13463-67-7: Titanium dioxide
Hazardous Substances Subject to Working Environment Measurement	Applicable	7440-50-8: Copper (Measurement Cycle: 6 months) (contains above 1%) 13463-67-7: Titanium dioxide (Measurement Cycle: 6 months) (contains above 1%)
Hazardous Substances Subject to Workers Requiring Health Examination	Applicable	7440-50-8: Copper (Examination Cycle: 12 months) (contains above 1%)
Hazardous Substances Subject to Control	Applicable	7440-50-8: Copper and its compounds (contains above 1%) 13463-67-7: Titanium dioxide (contains above 1%)
Chemical Substances Control Act		
Toxic Substances	Applicable	7440-50-8: Copper (Exclude if particles size ≥ 1mm) (Toxic-No.: 2025-1-1247 (contains above 1%))
Wastes Control Act		
Hazardous Substances in Designated wastes	Applicable	7440-50-8: Copper and its compounds (Contained in an effluent; Threshold condition to verify (contains above 3mg/l))
Act on Registration and Evaluation of Chemicals (K-REACH)		

Korea Existing Chemicals Inventory (KECI)	Applicable	9002-84-0: Tetrafluoroethene homopolymer; Polytetrafluoroethylene (KECI-No.: KE-33429) 65997-17-3: Glass, oxide (KECI-No.: KE-17630) 7440-50-8: Copper (KECI-No.: KE-08896) 26655-00-5: 1,1,1,2,2,3,3-Heptafluoro-3- [trifluoro ethenyl) oxy] propane, tetrafluoroethene polymer (KECI-No.: KE-18263) 60676-86-0: Silica, vitreous (KECI-No.: KE-30959) 13463-67-7: Titanium dioxide (KECI-No.: KE-33900)

Singapore

Regulation		Component / Mixture
Workplace Safety and Health Act & Workplace Safety and Health (General Provisions) Regulations	Applicable	Copper; Titanium dioxide
Environmental Protection and Management (Air Impurities) Regulations	Air Impurities Emission Limits	Copper
Environmental Public Health (Quality of Piped Drinking Water) Regulations	Drinking Water Quality Standards - Chemical Parameters	Copper

Taiwan

Occupational Safety and Health Act	Applicable	Polytetrafluoroethylene; Glass, oxide, chemicals; Copper; TETRAFLUOROETHYLENE- PERFLUORO (PROPYL VINYL ETHER COPOLYMER; Silica, vitreous; Titanium dioxide
Methods and Facilities Standards for the Storage, Clearance and Disposal of Industrial Waste	Applicable	Polytetrafluoroethylene; Glass, oxide, chemicals; Copper; TETRAFLUOROETHYLENE- PERFLUORO (PROPYL VINYL ETHER COPOLYMER; Silica, vitreous; Titanium dioxide
Traffic Safety Rule	Applicable	Polytetrafluoroethylene; Glass, oxide, chemicals; Copper; TETRAFLUOROETHYLENE- PERFLUORO (PROPYL VINYL ETHER COPOLYMER; Silica, vitreous; Titanium dioxide

15.3. US State regulations

California Proposition 65 - This product does not contain any substances known to the state of California to cause cancer, developmental and/or reproductive harm

Component	State or local regulations
Poly(tetrafluoroethylene) (9002-84-0)	U.S. - Pennsylvania - RTK (Right to Know) List
Copper (7440-50-8)	U.S. - Massachusetts - Right To Know List; U.S. - New Jersey - Right to Know Hazardous Substance List; U.S. - New York City - Right to Know Hazardous Substances List; U.S. - Pennsylvania - RTK (Right to Know) List
Silicon dioxide (60676-86-0)	U.S. - Massachusetts - Right To Know List; U.S. - New Jersey - Right to Know Hazardous Substance List
Titanium dioxide (13463-67-7)	U.S. - Massachusetts - Right To Know List; U.S. - New Jersey - Right to Know Hazardous Substance List; U.S. - New York City - Right to Know Hazardous Substances List; U.S. - Pennsylvania - RTK (Right to Know) List

SECTION 16: Other information

US-SDS according to the federal final rule of hazard communication revised on 2024 (HazCom 2024)

Revision date : Feb.1 2026

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.