KST-316

Material Safety Data Sheet

In Accordance with MOEL Public notice No 2020-130
MSDS Number: AA06900-0000000074
Issue date: 11/3/2020 Revision date: 9/10/2024 Version: 1.0

1. Chemical product and company identification

1.1. Product identifier

Product form : Mixture
Trade name : KST-316

1.2. Recommended uses and restrictions

1.2.1. Recommended use

Welding and soldering products, flux products.

1.2.2. Restrictions on use

1.2.3. Use Categories

35 - Welding and soldering products, flux products

1.3. Supplier information

- Supplier

Company : KISWEL
Address : (51544) South Korea 704, Gongdan-ro, Seongsan-gu, Changwon-si, Gyeongnam, Korea
Tel. : 055)269-7200
Fax : 055)266-4487

2. Hazards identification

2.1. Classification of the substance or mixture

Skin corrosion/irritation, Category 1	H314
Serious eye damage/eye irritation, Category 1	H318
Respiratory sensitisation, Category 1	H334
Skin sensitisation, Category 1	H317
Carcinogenicity, Category 2	H351
Specific target organ toxicity - Repeated exposure, Category 1	H372
Hazardous to the aquatic environment – Acute Hazard, Category 1	H400
Hazardous to the aquatic environment – Chronic Hazard, Category 3	H412

2.2. Label elements

2.2.1. Hazard pictograms (GHS KR)



2.2.2. Signal word (GHS KR)

Danger.

2.2.3. Hazard statements (GHS KR)

H314 - Causes severe skin burns and eye damage.
H317 - May cause an allergic skin reaction.
H318 - Causes serious eye damage.
H334 - May cause allergic reactions, asthma or shortness of breath and etc if inhaled.
H351 - Suspected of causing cancer.
H372 - Causes damage to organs through prolonged or repeated exposure.
H400 - Very toxic to aquatic life.
H412 - Harmful to aquatic life with long lasting effects.

2.2.4. Precautionary statements (GHS KR)

Precaution:

P201 - Obtain special instructions before use.
P202 - Do not handle until all safety precautions have been read and understood.
P260 - Do not breathe dust/fume/gas/mist/vapours/spray.
P261 - Avoid breathing dust/fume/gas/mist/vapours/spray.
P264 - Wash hands, forearms and face thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P272 - Contaminated work clothing should not be allowed out of the workplace.
P273 - Avoid release to the environment.
P280 - Wear protective gloves/protective clothing/eye protection/face protection/hearing protection.
P284 - Wear respiratory protection.

Treatment:

P301+P330+P331 - IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P302+P352 - IF ON SKIN: Wash with plenty of water/….
P303+P361+P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water.
P304+P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P305+P351+P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308+P313 - IF exposed or concerned: Get medical advice/attention.
P310 - Immediately call a POISON CENTER/doctor/….
P314 - Get medical advice/attention if you feel unwell.
P321 - Take … treatment.
P333+P313 - If skin irritation or rash occurs: Get medical advice/attention.
P342+P311 - If experiencing respiratory symptoms: Call a POISON CENTER/doctor/….
P362+P364 - Take off contaminated clothing and wash it before reuse.
P363 - Wash contaminated clothing before reuse.
P391 - Collect spillage.

Storage:

P405 - Store locked up.

Disposal:

P501 - Dispose of contents/container according to waste related regulations.

2.3. Hazards - Other hazards which do not result in classification - Hazard Risk

Not applicable

3. Composition/information on ingredients

Product form : Mixture

Substance name	Other Names	Product identifier number	Concentration (%)
Iron	Iron, elemental / Direct reduced Iron / Iron, reduced / Elemental iron / IRON POWDER / iron	CAS-No.: 7439-89-6 KECI-No.: KE-21059	41 – 45
Chromium	-	CAS-No.: 7440-47-3 KECI-No.: -	14 – 17
Titanium Dioxide	C.I. 77891 / C.I. Pigment White 6 / Titanium oxide (TiO2) / CI 77891 / Titanium(IV) oxide / C.I. Pigment White 7 / Pigment White 6 / Titanium dioxide nanoparticles / TITANIUM DIOXIDE / Titanium oxide / Titanium dioxide(2)	CAS-No.: 13463-67-7 KECI-No.: KE-33900	11 – 15

Substance name	Other Names	Product identifier number	Concentration (%)
Nickel	Nickel metal / Nickel, elemental / Nickel, metallic / Nickel, metal / C.I. 77775	CAS-No.: 7440-02-0 KECI-No.: KE-25818	6 – 10
Mica minerals	Mica dust / Mica group minerals / Silicates, mica / C.I. 77019 / Mica-group minerals / MICA / C.I. Pigment White 20 / Pigment White 20	CAS-No.: 12001-26-2 KECI-No.: KE-25420	3 – 7
Calcium carbonate	C.I. Pigment White 18 / Calcium carbonate / Pigment White 18 / C.I. 77220 / Carbonic acid, calcium salt / CALCIUM CARBONATE / CI 77220 / calcium carbonate	CAS-No.: 471-34-1 KECI-No.: KE-04487	1 – 5
Sodium silicate	Silicic acid, sodium salt / SODIUM SILICATE / Sodium silicates	CAS-No.: 1344-09-8 KECI-No.: KE-31002	1 – 5
CaF2	Calcium fluoride / Fluorspar / FLUORSPAR / CALCIUM FLUORIDE / Calcium difluoride / calcium fluoride	CAS-No.: 7789-75-5 KECI-No.: KE-04538	0.5 – 3
Feldspar minerals	Feldspar, group minerals / Feldspar-group minerals / Feldspar-group minerals (An inorganic substance that is the reaction product of high temperature calcination in which aluminum oxide, barium oxide, calcium oxide, magnesium oxide, silicon oxide, and strontium oxide in varying amounts are homogeneously and ionically interdiffused to form a crystalline matrix.) / Aventurine / Feldspar mineral / Feldspars, Feldspar-group minerals / Feldspars, feldspar-group minerals	CAS-No.: 68476-25-5 KECI-No.: KE-16962	0.5 – 3
Manganese	Manganese, elemental / Manganese metal / manganese	CAS-No.: 7439-96-5 KECI-No.: KE-22999	1 – 3
Molybdenum	Molybdenum metal / Molybdenum, elemental / Molybdenum, metal / Molybdenum, metallic / molybdenum	CAS-No.: 7439-98-7 KECI-No.: KE-25427	1 – 2

4. First-aid measures

4.1. First-aid measures after eye contact

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

4.2. First-aid measures after skin contact

Rinse skin with water/shower.
Take off immediately all contaminated clothing.
Call a physician immediately.

4.3. First-aid measures after inhalation

Remove person to fresh air and keep comfortable for breathing.
If experiencing respiratory symptoms: Call a poison center or a doctor.

4.4. First-aid measures after ingestion

Rinse mouth.
Do not induce vomiting.
Call a physician immediately.

4.5. Other medical advice or treatment

Treat symptomatically.

5. Fire-fighting measures

5.1. Suitable (and unsuitable) extinguishing media

Suitable extinguishing media	:	Water spray. Dry powder. Foam.
Unsuitable extinguishing media	:	No data available

5.2. Special hazards arising from the substance or mixture

No data available

5.3. Special protective equipment and precautions for fire-fighters

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

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Ventilate spillage area.
Do not breathe dust/fume/gas/mist/vapours/spray.
Avoid contact with skin and eyes.
Do not attempt to take action without suitable protective equipment.
For further information refer to section 8: "Exposure controls/personal protection".
Dispose of materials or solid residues at an authorized site.

6.2. Environmental precautions and protective procedures

Avoid release to the environment.

6.3. Methods and material for containment and cleaning up

Mechanically recover the product.
Notify authorities if product enters sewers or public waters.

7. Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling	:	Ensure good ventilation of the work station. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear personal protective equipment. Do not breathe dust/fume/gas/mist/vapours/spray. Avoid contact with skin and eyes.
Hygiene measures	:	Wash contaminated clothing before reuse. Contaminated work clothing should not be allowed out of the workplace. Do not eat, drink or smoke when using this product. Always wash hands after handling the product.

7.2. Conditions for safe storage

Storage conditions : Store locked up.
Store in a well-ventilated place.
Keep cool.

8. Exposure controls/personal protection

8.1. Occupational Exposure Limits

KST-316
No data available

Chromium (7440-47-3)	
Korea - Occupational Exposure Limits	
Local name	크롬 # Chromium
ISHA OEL TWA	0.5 mg/m³ (금속) # (Metal) 0.5 mg/m³ (2가)화합물 # (II) compounds, as Cr 0.5 mg/m³ (3가)화합물 # (III) compounds, as Cr
Regulatory reference	고용노동부고시 제2020-48호 # MOEL Public Notice. No. 2020-48

CaF2 (7789-75-5)	
China - Occupational Exposure Limits	
OEL PC-TWA	0.7 mg/m³ (mixed dust, respirable) 1 mg/m³ (mixed dust, total)
Catalogue of Occupational Hazard Factors	Category 1 - Dusts
USA - ACGIH - Occupational Exposure Limits	
ACGIH OEL TWA	2.5 mg/m³

Feldspar minerals (68476-25-5)
No data available

Iron (7439-89-6)	
Korea - Occupational Exposure Limits	
Local name	철염(가용성) # Iron salts (Soluble, as Fe)
ISHA OEL TWA	1 mg/m³
Regulatory reference	고용노동부고시 제2020-48호 # MOEL Public Notice. No. 2020-48
China - Occupational Exposure Limits	
Catalogue of Occupational Hazard Factors	Category 1 - Dusts
Indonesia - Occupational Exposure Limits	
NAB (OEL TWA)	1 mg/m³

Calcium carbonate (471-34-1)	
Korea - Occupational Exposure Limits	
Local name	탄산칼슘 # Calcium carbonate
ISHA OEL TWA	10 mg/m³
Regulatory reference	고용노동부고시 제2020-48호 # MOEL Public Notice. No. 2020-48

Calcium carbonate (471-34-1)	
China - Occupational Exposure Limits	
Catalogue of Occupational Hazard Factors	Category 3 - Chemicals
Vietnam - Occupational Exposure Limits	
OEL TWA	10 mg/m³
Australia - Occupational Exposure Limits	
OES TWA	10 mg/m³ (containing no asbestos and <1% crystalline silica-inhalable dust)
USA - NIOSH - Occupational Exposure Limits	
NIOSH REL TWA	10 mg/m³ (total dust) 5 mg/m³ (respirable dust)

Manganese (7439-96-5)	
Korea - Occupational Exposure Limits	
Local name	망간 및 무기 화합물 # Manganese&Inorganic compounds, as Mn
ISHA OEL TWA	1 mg/m³ 1 mg/m³ (흄) # (Fume)
ISHA OEL STEL	3 mg/m³ (흄) # (Fume)
ISHA PEL TWA	1 mg/m³
Regulatory reference	고용노동부고시 제2020-48호 # MOEL Public Notice. No. 2020-48
China - Occupational Exposure Limits	
OEL PC-TWA	0.15 mg/m³
OEL PC-TWA (Highly Toxic Goods)	0.15 mg/m³ (dust and fume)
OEL PC-STEL (Highly Toxic Goods)	0.45 mg/m³ (dust and fume)
Catalogue of Occupational Hazard Factors	Category 3 - Chemicals
India - Occupational Exposure Limits	
PEL (OEL TWA)	1 mg/m³ (fume)
PEL (OEL STEL)	0.03 mg/m³ (fume)
PEL (OEL C)	5 mg/m³ (dust)
Indonesia - Occupational Exposure Limits	
NAB (OEL TWA)	0.1 mg/m³ (inhalable particulate) 0.02 mg/m³ (respirable particulate)
Chemical category	A4 - not classifiable as a human carcinogen
Singapore - Occupational Exposure Limits	
PEL (OEL TWA)	1 mg/m³ (dust and fume)
OEL STEL	3 mg/m³ (fume)
Singapore - BTLV	
BTLV	50 µg/l Parameter: Manganese - Medium: urine
Taiwan - Occupational Exposure Limits	
OEL TWA	1 mg/m³ (category C3 special chemical-fume)
OEL STEL	2 mg/m³ (category C3 special chemical-fume)
OEL C	5 mg/m³ (category C3 special chemical)

Manganese (7439-96-5)	
Vietnam - Occupational Exposure Limits	
OEL TWA	0.3 mg/m³
OEL STEL	0.6 mg/m³
Australia - Occupational Exposure Limits	
OES TWA	1 mg/m³ (dust and fume)
OES STEL	3 mg/m³ (fume)
USA - ACGIH - Occupational Exposure Limits	
ACGIH OEL TWA	0.02 mg/m³ (respirable particulate matter) 0.1 mg/m³ (inhalable particulate matter)
ACGIH chemical category	Not Classifiable as a Human Carcinogen
USA - IDLH - Occupational Exposure Limits	
IDLH	500 mg/m³
USA - NIOSH - Occupational Exposure Limits	
NIOSH REL TWA	1 mg/m³ (fume)
NIOSH REL STEL	3 mg/m³
USA - OSHA - Occupational Exposure Limits	
OSHA PEL C	5 mg/m³ (fume)

Mica minerals (12001-26-2)	
Korea - Occupational Exposure Limits	
Local name	운모 # Mica
ISHA OEL TWA	3 mg/m³ 호흡성 # (Respirable fraction)
Regulatory reference	고용노동부고시 제2020-48호 # MOEL Public Notice. No. 2020-48
China - Occupational Exposure Limits	
OEL PC-TWA	2 mg/m³ (total dust) 1.5 mg/m³ (respirable dust)
Catalogue of Occupational Hazard Factors	Category 1 - Dusts
Indonesia - Occupational Exposure Limits	
NAB (OEL TWA)	3 mg/m³ (respirable particulate)
Singapore - Occupational Exposure Limits	
PEL (OEL TWA)	3 mg/m³ (respirable dust)
Taiwan - Occupational Exposure Limits	
OEL TWA	3 mg/m³ (respirable dust)
OEL STEL	6 mg/m³ (respirable dust)
Thailand - Occupational Exposure Limits	
OEL TWA	3 mg/m³ (respirable dust)
Australia - Occupational Exposure Limits	
OES TWA	2.5 mg/m³ (inspirable)
USA - ACGIH - Occupational Exposure Limits	
ACGIH OEL TWA	0.1 mg/m³ (respirable particulate matter)

Mica minerals (12001-26-2)	
USA - IDLH - Occupational Exposure Limits	
IDLH	1500 mg/m³ (containing <1% quartz)
USA - NIOSH - Occupational Exposure Limits	
NIOSH REL TWA	3 mg/m³ (containing <1% Quartz-respirable dust)

Nickel (7440-02-0)	
Korea - Occupational Exposure Limits	
Local name	니켈 (금속) # Nickel (Metal)
ISHA OEL TWA	1 mg/m³ (metal)
ISHA PEL TWA	0.2 mg/m³
Remark (KR)	발암성 2 # Carcinogenicity 2
Regulatory reference	고용노동부고시 제2020-48호 # MOEL Public Notice. No. 2020-48
China - Occupational Exposure Limits	
OEL PC-TWA	1 mg/m³
Chemical category	Possibly carcinogenic to humans
OEL PC-TWA (Highly Toxic Goods)	1 mg/m³
OEL PC-STEL (Highly Toxic Goods)	2.5 mg/m³
Catalogue of Occupational Hazard Factors	Category 3 - Chemicals
Indonesia - Occupational Exposure Limits	
NAB (OEL TWA)	1.5 mg/m³ (inhalable particulate)
Chemical category	A5 - not suspected as human carcinogen
Singapore - Occupational Exposure Limits	
PEL (OEL TWA)	1 mg/m³
Taiwan - Occupational Exposure Limits	
OEL TWA	1 mg/m³
OEL STEL	2 mg/m³
Thailand - Occupational Exposure Limits	
OEL TWA	1 mg/m³
Vietnam - Occupational Exposure Limits	
OEL TWA	0.05 mg/m³
OEL STEL	0.25 mg/m³
Australia - Occupational Exposure Limits	
OES TWA	1 mg/m³
USA - ACGIH - Occupational Exposure Limits	
ACGIH OEL TWA	1.5 mg/m³ (inhalable particulate matter)
ACGIH chemical category	Not Suspected as a Human Carcinogen
USA - ACGIH - Biological Exposure Indices	
BEI	5 µg/l Parameter: Nickel - Medium: urine - Sampling time: post-shift at end of workweek (background)

Nickel (7440-02-0)	
USA - IDLH - Occupational Exposure Limits	
IDLH	10 mg/m³
USA - NIOSH - Occupational Exposure Limits	
NIOSH REL TWA	0.015 mg/m³
USA - OSHA - Occupational Exposure Limits	
OSHA PEL TWA	1 mg/m³

Titanium Dioxide (13463-67-7)	
Korea - Occupational Exposure Limits	
Local name	이산화티타늄 # Titanium dioxide
ISHA OEL TWA	10 mg/m³
Remark (KR)	발암성 2 # Carcinogenicity 2
Regulatory reference	고용노동부고시 제2020-48호 # MOEL Public Notice. No. 2020-48
China - Occupational Exposure Limits	
OEL PC-TWA	8 mg/m³ (total dust)
Chemical category	Possibly carcinogenic to humans dust
Catalogue of Occupational Hazard Factors	Category 1 - Dusts
Indonesia - Occupational Exposure Limits	
NAB (OEL TWA)	10 mg/m³
Chemical category	A4 - not classifiable as a human carcinogen
Singapore - Occupational Exposure Limits	
PEL (OEL TWA)	10 mg/m³
Taiwan - Occupational Exposure Limits	
OEL TWA	10 mg/m³
OEL STEL	15 mg/m³
Vietnam - Occupational Exposure Limits	
OEL TWA	6 mg/m³ (inhalable dust) 5 mg/m³ (respirable dust)
OEL STEL	10 mg/m³ (inhalable dust)
Australia - Occupational Exposure Limits	
OES TWA	10 mg/m³ (containing no asbestos and <1% crystalline silica-inhalable dust)
USA - ACGIH - Occupational Exposure Limits	
ACGIH OEL TWA	10 mg/m³
ACGIH chemical category	Not Classifiable as a Human Carcinogen
USA - IDLH - Occupational Exposure Limits	
IDLH	5000 mg/m³
USA - NIOSH - Occupational Exposure Limits	
NIOSH REL TWA	2.4 mg/m³ (CIB 63-fine) 0.3 mg/m³ (CIB 63-ultrafine, including engineered nanoscale)

Titanium Dioxide (13463-67-7)	
USA - OSHA - Occupational Exposure Limits	
OSHA PEL TWA	15 mg/m³ (total dust)

Sodium silicate (1344-09-8)
No data available

Molybdenum (7439-98-7)	
Korea - Occupational Exposure Limits	
Local name	몰리브덴 (불용성화합물) # Molybdenum (Insoluble compounds)
ISHA OEL TWA	10 mg/m³ 흡입성 # (Inhalable fraction) 5 mg/m³ 호흡성 # (Respirable fraction)
Regulatory reference	고용노동부고시 제2020-48호 # MOEL Public Notice. No. 2020-48
Indonesia - Occupational Exposure Limits	
NAB (OEL TWA)	5 mg/m³ (respirable particulate)
Chemical category	A3 - confirmed animal carcinogen
Australia - Occupational Exposure Limits	
OES TWA	10 mg/m³
USA - ACGIH - Occupational Exposure Limits	
ACGIH OEL TWA	10 mg/m³ (inhalable particulate matter) 3 mg/m³ (respirable particulate matter)
USA - IDLH - Occupational Exposure Limits	
IDLH	5000 mg/m³

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. Personal protection

Respiratory protection

[In case of inadequate ventilation] wear respiratory protection.

Eye protection

Safety glasses

Hand protection

Protective gloves

Skin and body protection

Wear suitable protective clothing

Personal protective equipment symbol(s):



9. Physical and chemical properties

a) Appearance : No data available
Physical state : Solid

b)	Odour	: No data available
c)	Odour threshold	: No data available
d)	pH	: No data available
e)	Melting / freezing point	: No data available / Not applicable
f)	Initial boiling point and boiling range	: No data available
g)	Flash point	: Not applicable
h)	Evaporation rate	: No data available
i)	Flammability (solid, gas)	: Non flammable.
j)	Upper / lower flammability or explosive limits	: Not applicable
k)	Vapour pressure	: No data available
l)	Solubility	: No data available
m)	Vapour density	: No data available
n)	Relative density	: No data available
o)	Partition coefficient n-octanol/water (Log Kow)	: No data available
p)	Auto-ignition temperature	: Not applicable
q)	Decomposition temperature	: No data available
r)	Viscosity, kinematic	: Not applicable
	Viscosity, dynamic	: No data available
s)	Molecular mass	: No data available

10. Stability and reactivity

10.1. Chemical stability and Possibility of hazardous reactions

The product is non-reactive under normal conditions of use, storage and transport.
Stable under normal conditions.
No dangerous reactions known under normal conditions of use.

10.2. Conditions to avoid

None under recommended storage and handling conditions (see section 7).

10.3. Incompatible materials

No data available

10.4. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced.

11. Toxicological information

11.1. Information on exposure routes

Oral	: Not classified
Skin and eyes contact	: Skin corrosion/irritation - Causes severe skin burns. Serious eye damage/eye irritation - Causes serious eye damage. Skin sensitization - May cause an allergic skin reaction.
Inhalation	: Respiratory sensitization - May cause allergic reactions, asthma or shortness of breath and etc if inhaled.

11.2. Health hazards

Acute toxicity (oral):

Not classified

Acute toxicity (dermal):

Not classified

Acute toxicity (inhalation):

Not classified

Chromium (7440-47-3)	
LD50 oral rat	> 5000 mg/kg Source: ECHA
LC50 Inhalation - Rat	> 5.41 mg/l air Animal: rat, Guideline: OECD Guideline 403 (Acute Inhalation Toxicity)
LC50 Inhalation - Rat (Dust/Mist)	> 5.41 mg/l Source: ECHA

CaF2 (7789-75-5)	
LD50 oral rat	4250 mg/kg
LC50 Inhalation - Rat	> 5.07 mg/l air Animal: rat, Guideline: OECD Guideline 403 (Acute Inhalation Toxicity)

Iron (7439-89-6)	
LD50 oral rat	98600 mg/kg bodyweight Animal: rat, Animal sex: male, Guideline: OECD Guideline 401 (Acute Oral Toxicity)
LC50 Inhalation - Rat	> 250 mg/m³ air (6 h, Rat, Male, Experimental value, Inhalation (dust))

Calcium carbonate (471-34-1)	
LD50 oral rat	> 2000 mg/kg bodyweight Animal: rat, Animal sex: female, Guideline: OECD Guideline 420 (Acute Oral Toxicity - Fixed Dose Method), Guideline: EU Method B.1 bis (Acute Oral Toxicity - Fixed Dose Procedure)
LD50 dermal rat	> 2000 mg/kg bodyweight Animal: rat, Guideline: OECD Guideline 402 (Acute Dermal Toxicity), Guideline: EU Method B.3 (Acute Toxicity (Dermal))
LC50 Inhalation - Rat	> 3 mg/l air Animal: rat, Guideline: OECD Guideline 403 (Acute Inhalation Toxicity), Guideline: EU Method B.2 (Acute Toxicity (Inhalation)), Guideline: EPA OPPTS 870.1300 (Acute inhalation toxicity)

Manganese (7439-96-5)	
LD50 oral rat	> 2000 mg/kg bodyweight Animal: rat, Animal sex: female, Guideline: OECD Guideline 420 (Acute Oral Toxicity - Fixed Dose Method), Guideline: EU Method B.1 bis (Acute Oral Toxicity - Fixed Dose Procedure)
LC50 Inhalation - Rat	> 5.14 mg/l air Animal: rat, Guideline: OECD Guideline 403 (Acute Inhalation Toxicity), Guideline: EU Method B.2 (Acute Toxicity (Inhalation))
LC50 Inhalation - Rat (Dust/Mist)	> 5.14 mg/l Source: ECHA

Mica minerals (12001-26-2)	
LD50 oral rat	> 5000 mg/kg (Rat, Literature study, Oral)

Nickel (7440-02-0)	
LD50 oral rat	> 9000 mg/kg bodyweight Animal: rat, Guideline: OECD Guideline 401 (Acute Oral Toxicity)
LC50 Inhalation - Rat	> 10.2 mg/l (Exposure time: 1 h)

Titanium Dioxide (13463-67-7)	
LD50 oral rat	> 5000 mg/kg bodyweight Animal: rat, Animal sex: female, Guideline: OECD Guideline 425 (Acute Oral Toxicity: Up-and-Down Procedure), Guideline: EPA OPPTS 870.1100 (Acute Oral Toxicity)
LC50 Inhalation - Rat	> 6.82 mg/l (Other, 4 h, Rat, Male, Experimental value, Inhalation (dust), 14 day(s))
LC50 Inhalation - Rat (Dust/Mist)	> 3.43 mg/l Source: ECHA

Sodium silicate (1344-09-8)	
LD50 oral rat	3400 mg/kg Source: SIDS
LD50 dermal rat	> 5000 mg/kg bodyweight Animal: rat, Guideline: EPA OPPTS 870.1200 (Acute Dermal Toxicity)
LC50 Inhalation - Rat	> 2.06 mg/l air Animal: rat, Guideline: EPA OPPTS 870.1300 (Acute inhalation toxicity)

Molybdenum (7439-98-7)	
LD50 oral rat	> 2000 mg/kg Source: ECHA
LD50 dermal rat	> 2000 mg/kg bodyweight Animal: rat, Guideline: OECD Guideline 402 (Acute Dermal Toxicity)
LD50 dermal rabbit	> 2000 mg/kg Source: ECHA
LC50 Inhalation - Rat	> 5.84 mg/l/4h
LC50 Inhalation - Rat (Dust/Mist)	> 3.92 mg/l Source: ECHA

Skin corrosion/irritation:

Causes severe skin burns.

Serious eye damage/irritation:

Causes serious eye damage.

Respiratory sensitization:

May cause allergic reactions, asthma or shortness of breath and etc if inhaled.

Skin sensitization:

May cause an allergic skin reaction.

Carcinogenicity:

Suspected of causing cancer.

Chromium (7440-47-3)	
IARC group	3 - Not classifiable

Feldspar minerals (68476-25-5)	
IARC group	1 - Carcinogenic to humans

Nickel (7440-02-0)	
IARC group	2B - Possibly carcinogenic to humans

Titanium Dioxide (13463-67-7)	
IARC group	2B - Possibly carcinogenic to humans

Mutagenicity:

Not classified

Reproductive toxicity:

Not classified

STOT-single exposure:

Not classified

STOT-repeated exposure:

Causes damage to organs through prolonged or repeated exposure.

Chromium (7440-47-3)	
LOAEC (inhalation, rat, dust/mist/fume, 90 days)	≥ 0.0044 mg/l air Animal: rat, Guideline: OECD Guideline 413 (Subchronic Inhalation Toxicity: 90-Day Study)

Calcium carbonate (471-34-1)	
NOAEL (oral, rat, 90 days)	1000 mg/kg bodyweight Animal: rat, Guideline: OECD Guideline 422 (Combined Repeated Dose Toxicity Study with the Reproduction / Developmental Toxicity Screening Test)
NOAEC (inhalation, rat, dust/mist/fume, 90 days)	≥ 0.212 mg/l air Animal: rat, Guideline: OECD Guideline 413 (Subchronic Inhalation Toxicity: 90-Day Study)

Nickel (7440-02-0)	
LOAEC (inhalation, rat, dust/mist/fume, 90 days)	0.004 mg/l air Animal: rat, Guideline: OECD Guideline 412 (Subacute Inhalation Toxicity: 28-Day Study)
STOT-repeated exposure	Causes damage to organs through prolonged or repeated exposure.

Molybdenum (7439-98-7)	
NOAEC (inhalation, rat, dust/mist/fume, 90 days)	> 0.1 mg/l air Animal: rat, Guideline: OECD Guideline 413 (Subchronic Inhalation Toxicity: 90-Day Study)
STOT-repeated exposure	May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard:

Not classified

KST-316	
Viscosity, kinematic	Not applicable

CaF2 (7789-75-5)	
Density	3.18 g/cm³ Type: 'density'

Iron (7439-89-6)	
Density	7.87 g/cm³ Type: 'density' Temp.: 20 °C

Calcium carbonate (471-34-1)	
Viscosity, kinematic (calculated value) (40 °C)	Not applicable (solid)
Density	2.7 – 2.9 g/cm³ (at 20 °C)
Viscosity, kinematic	Not applicable (solid)
Viscosity, dynamic	Not applicable (solid)

Manganese (7439-96-5)	
Density	7200 kg/m³

Nickel (7440-02-0)	
Viscosity, kinematic (calculated value) (40 °C)	Not applicable (solid)
Density	8.9 g/cm³ (at 25 °C)
Viscosity, kinematic	Not applicable (solid)

Nickel (7440-02-0)	
Viscosity, dynamic	Not applicable (solid)

Titanium Dioxide (13463-67-7)	
Viscosity, kinematic (calculated value) (40 °C)	Not applicable (solid)
Density	3.9 – 4.1 g/cm³
Viscosity, kinematic	Not applicable (solid)
Viscosity, dynamic	Not applicable (solid)

Sodium silicate (1344-09-8)	
Density	1350 – 1380 kg/m³

Molybdenum (7439-98-7)	
Density	10.2 g/cm³ (at 20 °C)

12. Ecological information

12.1. Ecotoxicity

Ecology - general : Harmful to aquatic life with long lasting effects.

Hazardous to the aquatic environment, short–term (acute) : Very toxic to aquatic life.

Hazardous to the aquatic environment, long–term (chronic) : Harmful to aquatic life with long lasting effects.

Chromium (7440-47-3)	
LC50 - Fish [1]	13.9 – 210 mg/l Source: GESTIS
EC50 - Crustacea [1]	13.1 – 14.7 mg/l Test organisms (species): Daphnia magna
EC50 72h - Algae [1]	0.1 – 17.8 mg/l Source: GESTIS
Partition coefficient n-octanol/water (Log Kow)	0.23
Partition coefficient n-octanol/water (Log Pow)	0.23 Source: SRC

CaF2 (7789-75-5)	
LC50 - Fish [1]	51 mg/l Test organisms (species): other:summary of finidngs in various species
LC50 - Fish [2]	165 mg/l Test organisms (species): other:summary of finidngs in various species
EC50 - Crustacea [1]	97 – 270 mg/l (48 h, Daphnia magna, Static system, Fresh water, Literature, Fluorine ion)
EC50 96h - Algae [1]	7444.076 mg/l Source: Ecological Structure Activity Relationships
EC50 72h - Algae [1]	> 100 mg/l Test organisms (species): Pseudokirchneriella subcapitata (previous names: Raphidocelis subcapitata, Selenastrum capricornutum)
NOEC (chronic)	14.1 mg/l Test organisms (species): Daphnia magna Duration: '21 d'
NOEC chronic fish	4 mg/l Test organisms (species): Oncorhynchus mykiss (previous name: Salmo gairdneri) Duration: '21 d'

Iron (7439-89-6)	
LC50 - Fish [1]	8.65 mg/l Source: ECHA

Iron (7439-89-6)	
LC50 - Other aquatic organisms [1]	106.3 mg/l Source: ECHA
EC50 - Crustacea [1]	> 100 mg/l Test organisms (species): Daphnia magna
EC50 - Crustacea [2]	> 10000 mg/l Test organisms (species): Daphnia magna
EC50 72h - Algae [1]	18 mg/l Source: ECHA

Calcium carbonate (471-34-1)	
LC50 - Fish [1]	> 56000 mg/l Source: ECOTOX
EC50 - Crustacea [1]	> 100 % (OECD 202: Daphnia sp. Acute Immobilisation Test, 48 h, Daphnia magna, Static system, Fresh water, Experimental value, Locomotor effect)
EC50 96h - Algae [1]	22000 mg/l Source: Ecological Structure Activity Relationships
EC50 72h - Algae [1]	> 14 mg/l Test organisms (species): Desmodesmus subspicatus (previous name: Scenedesmus subspicatus)
ErC50 algae	> 100 mg/l (OECD 201: Alga, Growth Inhibition Test, 72 h, Pseudokirchneriella subcapitata, Static system, Fresh water, Experimental value, Nominal concentration)
BCF - Fish [1]	(no bioaccumulation)

Manganese (7439-96-5)	
LC50 - Fish [1]	> 3.6 mg/l Test organisms (species): Oncorhynchus mykiss (previous name: Salmo gairdneri)
EC50 - Crustacea [1]	> 1.6 mg/l Test organisms (species): Daphnia magna
EC50 72h - Algae [1]	4.5 mg/l Test organisms (species): Desmodesmus subspicatus (previous name: Scenedesmus subspicatus)
EC50 72h - Algae [2]	2.8 mg/l Test organisms (species): Desmodesmus subspicatus (previous name: Scenedesmus subspicatus)
NOEC (chronic)	1.7 mg/l Test organisms (species): Ceriodaphnia dubia Duration: '8 d'
BCF - Fish [1]	81 (Pisces)
BCF - Other aquatic organisms [1]	300000 (Mollusca)
BCF - Other aquatic organisms [2]	125000 (Crustacea)

Nickel (7440-02-0)	
LC50 - Fish [1]	> 100 mg/l (Exposure time: 96 h - Species: Brachydanio rerio)
LC50 - Fish [2]	1.3 mg/l (Exposure time: 96 h - Species: Cyprinus carpio [semi-static])
EC50 - Crustacea [1]	> 100 mg/l (Exposure time: 48 h - Species: Daphnia magna)
EC50 - Crustacea [2]	1 mg/l (Exposure time: 48 h - Species: Daphnia magna [Static])
EC50 96h - Algae [1]	0.174 – 0.311 mg/l (Species: Pseudokirchneriella subcapitata [static])
EC50 72h - Algae [1]	0.18 mg/l (Species: Pseudokirchneriella subcapitata)
BCF - Other aquatic organisms [1]	8 – 45 (≤ 4 week(s), Cambarus sp., Flow-through system, Fresh water, Experimental value, Fresh weight)

Titanium Dioxide (13463-67-7)	
LC50 - Fish [1]	155 mg/l Test organisms (species): other:Japanese Medaka
EC50 - Crustacea [1]	19.3 mg/l Test organisms (species): Daphnia magna

Titanium Dioxide (13463-67-7)	
EC50 - Crustacea [2]	27.8 mg/l Test organisms (species): Daphnia magna
EC50 - Other aquatic organisms [1]	> 100 mg/l Test organisms (species):
EC50 72h - Algae [1]	> 100 mg/l Test organisms (species): Pseudokirchneriella subcapitata (previous names: Raphidocelis subcapitata, Selenastrum capricornutum)
ErC50 algae	61 mg/l (EPA 600/9-78-018, 72 h, Pseudokirchneriella subcapitata, Static system, Fresh water, Experimental value, Nominal concentration)
LOEC (chronic)	5 mg/l Test organisms (species): Daphnia magna Duration: '21 d'
NOEC (chronic)	≥ 2.92 mg/l Test organisms (species): Daphnia magna Duration: '21 d'

Sodium silicate (1344-09-8)	
LC50 - Fish [1]	1108 mg/l Test organisms (species): Danio rerio (previous name: Brachydanio rerio)
LC50 - Fish [2]	3185 mg/l (Exposure time: 96 h - Species: Brachydanio rerio [semi-static])
EC50 - Crustacea [1]	1700 mg/l Test organisms (species): Daphnia magna
EC50 - Crustacea [2]	160 mg/l (96 h, Amphipoda)
EC50 72h - Algae [1]	207 mg/l Test organisms (species): Desmodesmus subspicatus (previous name: Scenedesmus subspicatus)
EC50 72h - Algae [2]	> 345.4 mg/l Test organisms (species): Desmodesmus subspicatus (previous name: Scenedesmus subspicatus)
BCF - Fish [1]	(no bioaccumulation expected)

Molybdenum (7439-98-7)	
LC50 - Fish [1]	609.1 mg/l Source: EHCA
EC50 72h - Algae [1]	289.2 mg/l Source: ECHA
BCF - Fish [1]	260 – 500 (Tilapia rendalli)
Partition coefficient n-octanol/water (Log Pow)	0.23 Source: SRC Access on Jan 2006

12.2. Persistence and degradability

KST-316	
Persistence and degradability	Rapidly degradable

Chromium (7440-47-3)	
Persistence and degradability	Rapidly degradable

CaF2 (7789-75-5)	
Persistence and degradability	Biodegradability: not applicable.
Chemical oxygen demand (COD)	Not applicable (inorganic)
ThOD	Not applicable (inorganic)

Feldspar minerals (68476-25-5)	
Persistence and degradability	Biodegradability in soil: not applicable.
Chemical oxygen demand (COD)	Not applicable
ThOD	Not applicable

Feldspar minerals (68476-25-5)	
BOD (% of ThOD)	Not applicable

Iron (7439-89-6)	
Persistence and degradability	Biodegradability in soil: not applicable,Biodegradability: not applicable.
Chemical oxygen demand (COD)	Not applicable
ThOD	Not applicable
BOD (% of ThOD)	Not applicable

Calcium carbonate (471-34-1)	
Persistence and degradability	Biodegradability in soil: not applicable,Biodegradability: not applicable.
Chemical oxygen demand (COD)	Not applicable (inorganic)
ThOD	Not applicable (inorganic)

Manganese (7439-96-5)	
Persistence and degradability	Biodegradability: not applicable.
Chemical oxygen demand (COD)	Not applicable
ThOD	Not applicable
BOD (% of ThOD)	Not applicable

Mica minerals (12001-26-2)	
Persistence and degradability	Biodegradability: not applicable.
Chemical oxygen demand (COD)	Not applicable (inorganic)
ThOD	Not applicable (inorganic)

Nickel (7440-02-0)	
Persistence and degradability	Biodegradability in soil: not applicable,Biodegradability: not applicable.
Chemical oxygen demand (COD)	Not applicable (inorganic)
ThOD	Not applicable (inorganic)

Titanium Dioxide (13463-67-7)	
Persistence and degradability	Biodegradability: not applicable.
Chemical oxygen demand (COD)	Not applicable (inorganic)
ThOD	Not applicable (inorganic)

Sodium silicate (1344-09-8)	
Persistence and degradability	Biodegradability: not applicable.
Chemical oxygen demand (COD)	Not applicable
ThOD	Not applicable
BOD (% of ThOD)	Not applicable

Molybdenum (7439-98-7)	
Persistence and degradability	Biodegradability: not applicable.
Chemical oxygen demand (COD)	Not applicable
ThOD	Not applicable
BOD (% of ThOD)	Not applicable

12.3. Bioaccumulative potential

Chromium (7440-47-3)	
Partition coefficient n-octanol/water (Log Pow)	0.23 Source: SRC
Partition coefficient n-octanol/water (Log Kow)	0.23

CaF2 (7789-75-5)	
Bioaccumulative potential	No bioaccumulation data available.

Feldspar minerals (68476-25-5)	
Bioaccumulative potential	No bioaccumulation data available.

Iron (7439-89-6)	
Bioaccumulative potential	No bioaccumulation data available.

Calcium carbonate (471-34-1)	
BCF - Fish [1]	(no bioaccumulation)
Bioaccumulative potential	Not bioaccumulative.

Manganese (7439-96-5)	
BCF - Fish [1]	81 (Pisces)
BCF - Other aquatic organisms [1]	300000 (Mollusca)
BCF - Other aquatic organisms [2]	125000 (Crustacea)
Bioaccumulative potential	No bioaccumulation data available.

Mica minerals (12001-26-2)	
Bioaccumulative potential	No bioaccumulation data available.

Nickel (7440-02-0)	
BCF - Other aquatic organisms [1]	8 – 45 (≤ 4 week(s), Cambarus sp., Flow-through system, Fresh water, Experimental value, Fresh weight)
Bioaccumulative potential	Low potential for bioaccumulation (BCF < 500).

Titanium Dioxide (13463-67-7)	
Bioaccumulative potential	Not bioaccumulative.

Sodium silicate (1344-09-8)	
BCF - Fish [1]	(no bioaccumulation expected)

Sodium silicate (1344-09-8)	
Bioaccumulative potential	Bioaccumulation: not applicable.

Molybdenum (7439-98-7)	
BCF - Fish [1]	260 – 500 (Tilapia rendalli)
Partition coefficient n-octanol/water (Log Pow)	0.23 Source: SRC Access on Jan 2006
Bioaccumulative potential	No bioaccumulation data available.

12.4. Mobility in soil

Chromium (7440-47-3)	
Partition coefficient n-octanol/water (Log Pow)	0.23 Source: SRC
Partition coefficient n-octanol/water (Log Kow)	0.23

CaF2 (7789-75-5)	
Ecology - soil	No (test)data on mobility of the substance available.

Iron (7439-89-6)	
Surface tension	Not applicable (solid)
Ecology - soil	Adsorbs into the soil.

Calcium carbonate (471-34-1)	
Mobility in soil	4.971 Source: Quantitative Structure Activity Relation
Surface tension	No data available (test not performed)
Ecology - soil	Low potential for adsorption in soil.

Manganese (7439-96-5)	
Ecology - soil	No (test)data on mobility of the substance available.

Mica minerals (12001-26-2)	
Ecology - soil	No (test)data on mobility of the substance available.

Nickel (7440-02-0)	
Surface tension	Not applicable (solid)
Ecology - soil	No (test)data on mobility of the substance available.

Titanium Dioxide (13463-67-7)	
Surface tension	No data available in the literature
Ecology - soil	Low potential for mobility in soil.

Sodium silicate (1344-09-8)	
Ecology - soil	No (test)data on mobility of the component(s) available.

Molybdenum (7439-98-7)	
Partition coefficient n-octanol/water (Log Pow)	0.23 Source: SRC Access on Jan 2006
Ecology - soil	Adsorbs into the soil.

12.5. Other adverse effects

Ozone : Not classified
Other adverse effects : No data available

13. Disposal considerations

13.1. Disposal method

Waste treatment methods : Dispose of contents/container in accordance with licensed collector's sorting instructions.

13.2. Disposal precaution

No data available

14. Transport information

In accordance with UN RTDG / ADR / IMDG / IATA

UN RTDG	ADR	IMDG	IATA
14.1. UN number			
Not applicable	Not applicable	Not applicable	Not applicable
14.2. UN proper shipping name			
Not applicable	Not applicable	Not applicable	Not applicable
14.3. Transport hazard class(es)			
Not applicable	Not applicable	Not applicable	Not applicable
14.4. Packing group			
Not applicable	Not applicable	Not applicable	Not applicable
14.5. Marine pollutant			
Not applicable	Not applicable	Not applicable	Not applicable
No data available			

14.6. Special precautions for user

No data available

15. Regulatory information

15.1. Occupational Safety and Health Act

Hazardous Substances Prohibited for Manufacturing	Not applicable	
Hazardous Substances Requiring Permission	Not applicable	
Threshold Limit Values Chemicals	Applicable	7440-47-3: Chromium 7439-89-6: Iron salts (Soluble, as Fe) 7439-96-5: Manganese&Inorganic compounds, as Mn 12001-26-2: Mica 7440-02-0: Nickel 13463-67-7: Titanium dioxide 7439-98-7: Molybdenum
Hazardous Substances Below Permissible Level	Applicable	7439-96-5: Manganese and its inorganic compounds

Hazardous Substances Subject to Working Environment Measurement	Applicable	7440-02-0: Nickel and its insoluble inorganic compounds 7440-47-3: Chromium and its inorganic compounds (contains above 1%) 7439-96-5: Manganese and its inorganic compounds 12001-26-2: Mica 7440-02-0: Nickel and its inorganic compounds 13463-67-7: Titanium dioxide
Hazardous Substances Subject to Workers Requiring Health Examination	Applicable	7440-47-3: Chromium and its compounds (contains above 1%) 7439-96-5: Manganese and its inorganic compounds 12001-26-2: Mineral dusts 7440-02-0: Nickel and its inorganic compounds
Hazardous Substances Subject to Control	Applicable	7440-47-3: Chromium and its compounds(except Chromium(VI) compounds) (contains above 1%) 7439-89-6: Iron and its compounds 7439-96-5: Manganese and its inorganic compounds 7440-02-0: Nickel and its inorganic compounds 13463-67-7: Titanium dioxide

15.2. Chemicals Control Act

No data available

15.3. ACT ON REGISTRATION, EVALUATION, ETC. OF CHEMICALS (K-REACH)

No data available

15.4. Safety Control of Dangerous Substances Act

Safety Control of Dangerous Substances Act	Applicable	KST-316 (Class 2 Combustible solid - category 5 Metal powder (Designated quantity: 500kg); Class 2 Combustible solid - category 4 Iron Powder (Designated quantity: 500kg)) 7440-47-3: Chromium powder (Class 2 Combustible solid - category 5 Metal powder (Designated quantity: 500kg)) 7439-89-6: Iron powder (Class 2 Combustible solid - category 4 Iron Powder (Designated quantity: 500kg)) 7439-96-5: Manganese powder (Class 2 Combustible solid - category 5 Metal powder (Designated quantity: 500kg)) 7439-98-7: Molybdenum powder (Class 2 Combustible solid - category 5 Metal powder (Designated quantity: 500kg))

15.5. Wastes Control Act

Hazardous Substances in Designated wastes	Not applicable
Types of wastes	No data available

15.6. Other Domestic and International Regulatory Information

Domestic

Persistent Organic Pollutants(POPs) Control Act	Not applicable
Ozone Depleting Substances(ODS)	Not applicable

International

EU Regulatory Information

EU Candidate list (SVHC)	Contains no substance on the REACH candidate list
EU authorization list (REACH Annex XIV)	Contains no REACH Annex XIV substances
EU restriction list (REACH Annex XVII)	Not applicable

US Regulatory Information

CERCLA Section 103 (40CFR302.4)	Contains listed substances
EPCRA Section 302 (40CFR355.30)	Not applicable
EPCRA Section 304 (40CFR355.40)	Not applicable
EPCRA Section 313 (40CFR372.65)	Contains listed substances

16. Other information

16.1. Data sources

REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006,Classification according to Classification, Labelling and Packaging of Substances and Mixtures (SEA) Regulation published in the Official Journal numbered 28848 on December 11, 2013,ECHA (European Chemicals Agency),Supplier's safety documents,No data available,This MSDS is prepared based on Article 41 of the Occupational Safety and Health Act and Notice No.2016-19 of the Ministry of Employment and Labor (based on the availability of material safety and health data), taking into account the status of regulations related to Korea,This MSDS is prepared based on KOSHA, NITE, ESIS, NLM, SIDS, IPCS, NCIS, etc,This safety data sheet was compiled with data and information from the following sources : RTECS, ECOSAR, HSDB, SIDS SIAP, ChemWATCH, CESAR, Chemical DB.

16.2. Issue date

11/3/2020

16.3. Revision number and date

Version	:	1.0
Revision date	:	9/10/2024

16.4. Other information

No data available

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.