T-347

Material Safety Data Sheet

In Accordance with MOEL Public notice No 2020-130
MSDS Number: AA06900-0000000045
Issue date: 11/3/2020 Revision date: 2/16/2023 Version: 4.0

1. Chemical product and company identification

1.1. Product identifier

Product form : Mixture
Trade name : T-347

1.2. Recommended uses and restrictions

Use Categories

35 - Welding and soldering products, flux products

1.2.1. Recommended use

Welding and soldering products, flux products.

1.2.2. Restrictions on use

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

Respiratory sensitisation, Category 1	H334
Skin sensitisation, Category 1	H317
Carcinogenicity, Category 2	H351
Specific target organ toxicity - Single exposure, Category 3, Narcosis	H336
Specific target organ toxicity - Repeated exposure, Category 1	H372
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)

H317 - May cause an allergic skin reaction.
H334 - May cause allergic reactions, asthma or shortness of breath and etc if inhaled.
H336 - May cause drowsiness or dizziness.
H351 - Suspected of causing cancer.
H372 - Causes damage to organs through prolonged or repeated exposure.
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.
P271 - Use only outdoors or in a well-ventilated area.
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:

P302+P352 - IF ON SKIN: Wash with plenty of water/….
P304+P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P308+P313 - IF exposed or concerned: Get medical advice/attention.
P312 - Call a POISON CENTER/doctor/… if you feel unwell.
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.

Storage:

P403+P233 - Store in a well-ventilated place. Keep container tightly closed.
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	58.8 – 67.5
Chromium	Chromium metal / Chromium, elemental / Chromium, metal / Chromium, metallic / Chrome, metal / Chrome	CAS-No.: 7440-47-3 KECI-No.: KE-05970	19 – 21.5
Nickel	Nickel metal / Nickel, elemental / Nickel, metallic / Nickel, metal / C.I. 77775	CAS-No.: 7440-02-0 KECI-No.: KE-25818	9 – 11
Molybdenum	Molybdenum metal / Molybdenum, elemental / Molybdenum, metal / Molybdenum, metallic / molybdenum	CAS-No.: 7439-98-7 KECI-No.: KE-25427	3 – 3.4
Manganese	Manganese, elemental / Manganese metal / manganese	CAS-No.: 7439-96-5 KECI-No.: KE-22999	1 – 2.5

Substance name	Other Names	Product identifier number	Concentration (%)
Silicon Metal	Silicon powder / Silicon powder, amorphous / Ammonium hexafluorosilicate / SILICON / silicon	CAS-No.: 7440-21-3 KECI-No.: KE-31029	0.3 – 0.7
Copper	C.I. 77400 / C.I. Pigment Metal 2 / Copper, elemental / CI 77400 / Copper metal / Copper, metallic / Pigment Metal 2 / Granulated copper / copper	CAS-No.: 7440-50-8 KECI-No.: KE-08896	≤ 0.5

4. First-aid measures

4.1. First-aid measures after eye contact

Rinse eyes with water as a precaution.

4.2. First-aid measures after skin contact

Wash skin with plenty of water.
Take off contaminated clothing.
If skin irritation or rash occurs: Get medical advice/attention.

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

Call a poison center or a doctor if you feel unwell.

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	:	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. Use only outdoors or in a well-ventilated area. Avoid contact with skin and eyes.
Hygiene measures	:	Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reuse. 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 container tightly closed. Keep cool.

8. Exposure controls/personal protection

8.1. Occupational Exposure Limits

T-347	
No data available	
Silicon Metal (7440-21-3)	
Korea - Occupational Exposure Limits	
Local name	실리콘 # Silicon
ISHA OEL TWA	10 mg/m³
Regulatory reference	고용노동부고시 제2020-48호 # MOEL Public Notice. No. 2020-48
Indonesia - Occupational Exposure Limits	
NAB (OEL TWA)	10 mg/m³ (not containing Asbestos and the crystal content is <1%)
Singapore - Occupational Exposure Limits	
PEL (OEL TWA)	10 mg/m³
Australia - Occupational Exposure Limits	
OES TWA [1]	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)

Silicon Metal (7440-21-3)	
USA - OSHA - Occupational Exposure Limits	
OSHA PEL TWA [1]	15 mg/m³ (total dust) 5 mg/m³ (respirable fraction)

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)
Vietnam - Occupational Exposure Limits	
OEL TWA	0.3 mg/m³
OEL STEL	0.6 mg/m³
Australia - Occupational Exposure Limits	
OES TWA [1]	1 mg/m³ (dust and fume)
OES STEL	3 mg/m³ (fume)

Manganese (7439-96-5)	
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)

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
China - Occupational Exposure Limits	
OEL PC-TWA	1 mg/m³ (dust) 0.2 mg/m³ (fume)
Catalogue of Occupational Hazard Factors	Category 3 - Chemicals
India - Occupational Exposure Limits	
PEL (OEL TWA)	0.2 mg/m³ (fume)
Indonesia - Occupational Exposure Limits	
NAB (OEL TWA)	1 mg/m³ (dust and mist) 0.2 mg/m³ (fume)
Singapore - Occupational Exposure Limits	
PEL (OEL TWA)	0.2 mg/m³ (fume) 1 mg/m³ (dust and mist)
Taiwan - Occupational Exposure Limits	
OEL TWA	0.2 mg/m³ (fume) 1 mg/m³ (dust and mist)
OEL STEL	0.6 mg/m³ (fume) 2 mg/m³ (dust and mist)
Vietnam - Occupational Exposure Limits	
OEL TWA	0.5 mg/m³ (dust) 0.1 mg/m³ (fume)
OEL STEL	1 mg/m³ (dust) 0.2 mg/m³ (fume)

Copper (7440-50-8)	
Australia - Occupational Exposure Limits	
OES TWA [1]	1 mg/m³ (dust and mist) 0.2 mg/m³ (fume)
USA - ACGIH - Occupational Exposure Limits	
ACGIH OEL TWA	0.2 mg/m³ (fume)
USA - IDLH - Occupational Exposure Limits	
IDLH	100 mg/m³ (dust, fume and mist)
USA - NIOSH - Occupational Exposure Limits	
NIOSH REL TWA	1 mg/m³ (dust and mist) 0.1 mg/m³ (fume)
USA - OSHA - Occupational Exposure Limits	
OSHA PEL TWA [1]	0.1 mg/m³ (fume) 1 mg/m³ (dust and mist)

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

Nickel (7440-02-0)	
Australia - Occupational Exposure Limits	
OES TWA [1]	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)
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]	1 mg/m³

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 [1]	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

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

Chromium (7440-47-3)	
Korea - Occupational Exposure Limits	
ISHA OEL TWA	0.5 mg/m³ (metal)
China - Occupational Exposure Limits	
OEL PC-TWA	0.05 mg/m³
Chemical category	Sensitizer, Carcinogenic to humans
OEL PC-TWA (Highly Toxic Goods)	0.15 mg/m³
OEL MAC (Highly Toxic Goods)	0.05 mg/m³
Catalogue of Occupational Hazard Factors	Category 3 - Chemicals
Indonesia - Occupational Exposure Limits	
NAB (OEL TWA)	0.5 mg/m³
Chemical category	A4 - not classifiable as a human carcinogen
Singapore - Occupational Exposure Limits	
PEL (OEL TWA)	0.5 mg/m³
Taiwan - Occupational Exposure Limits	
OEL TWA	1 mg/m³
OEL STEL	2 mg/m³
Australia - Occupational Exposure Limits	
OES TWA [1]	0.5 mg/m³
USA - ACGIH - Occupational Exposure Limits	
ACGIH OEL TWA	0.5 mg/m³ (inhalable particulate matter)
USA - ACGIH - Biological Exposure Indices	
BEI	0.7 µg/l Parameter: Total chromium - Medium: urine - Sampling time: end of shift at end of workweek (population based)
USA - IDLH - Occupational Exposure Limits	
IDLH	250 mg/m³
USA - NIOSH - Occupational Exposure Limits	
NIOSH REL TWA	0.5 mg/m³
USA - OSHA - Occupational Exposure Limits	
OSHA PEL TWA [1]	1 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	:	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 : May cause an allergic skin reaction.
Inhalation : 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

Silicon Metal (7440-21-3)	
LD50 oral rat	> 5000 mg/kg bodyweight Animal: rat, Guideline: OECD Guideline 401 (Acute Oral Toxicity)
LD50 dermal rabbit	> 5000 mg/kg bodyweight Animal: rabbit

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

Copper (7440-50-8)	
LD50 oral rat	300 – 500 mg/kg Source: ECHA
LD50 dermal rat	> 2000 mg/kg bodyweight 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:MAFF 4200 (1985)
LC50 Inhalation - Rat	> 5.11 mg/l air Animal: rat, Guideline: OECD Guideline 436 (Acute Inhalation Toxicity: Acute Toxic Class Method)

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)

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

Molybdenum (7439-98-7)	
LC50 Inhalation - Rat (Dust/Mist)	> 3.92 mg/l Source: ECHA

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))

Chromium (7440-47-3)	
LD50 oral rat	> 5000 mg/kg bodyweight (Equivalent or similar to OECD 420, Rat, Male / female, Read-across, Oral, 14 day(s))
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

Skin corrosion/irritation:

Not classified

Serious eye damage/irritation:

Not classified

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.

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

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

Mutagenicity:

Not classified

Reproductive toxicity:

Not classified

STOT-single exposure:

May cause drowsiness or dizziness.

STOT-repeated exposure:

Causes damage to organs through prolonged or repeated exposure.

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)

Molybdenum (7439-98-7)	
STOT-repeated exposure	May cause 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)
STOT-repeated exposure	Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard:

Not classified

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Viscosity, kinematic	Not applicable

Silicon Metal (7440-21-3)	
Density	2.33 g/cm³ Type: 'density' Temp.: 25 °C
Viscosity, dynamic	Not applicable (solid)

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

Copper (7440-50-8)	
Density	0.47 g/ml Type: 'tap density' Temp.: 20 °C

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)
Viscosity, dynamic	Not applicable (solid)

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

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

Chromium (7440-47-3)	
Density	7.19 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) : Not classified

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

Silicon Metal (7440-21-3)	
LC50 - Fish [1]	100 mg/l (Pisces)
EC50 72h - Algae [1]	250 mg/l Test organisms (species): Pseudokirchneriella subcapitata (previous names: Raphidocelis subcapitata, Selenastrum capricornutum)
ErC50 algae	250 mg/l (Equivalent or similar to OECD 201, 72 h, Pseudokirchneriella subcapitata, Static system, Fresh water, Weight of evidence)

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)

Copper (7440-50-8)	
LC50 - Fish [1]	0.0068 – 0.0156 mg/l (Exposure time: 96 h - Species: Pimephales promelas)
LC50 - Fish [2]	< 0.3 mg/l (Exposure time: 96 h - Species: Pimephales promelas [static])
EC50 - Crustacea [1]	0.03 mg/l (Exposure time: 48 h - Species: Daphnia magna [Static])
EC50 96h - Algae [1]	0.031 – 0.054 mg/l (Species: Pseudokirchneriella subcapitata [static])
EC50 72h - Algae [1]	0.0426 – 0.0535 mg/l (Species: Pseudokirchneriella subcapitata [static])
Partition coefficient n-octanol/water (Log Pow)	-0.57 Source: EPISUITE

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)

Molybdenum (7439-98-7)	
LC50 - Fish [1]	609.1 mg/l Source: EHCA
EC50 72h - Algae [1]	289.2 mg/l Source: ECHA

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

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

Chromium (7440-47-3)	
LC50 - Fish [1]	13.9 – 210 mg/l Source: GESTIS
EC50 - Crustacea [1]	17.7 – 18.9 mg/l Source: ECHA
EC50 72h - Algae [1]	0.1 – 17.8 mg/l Source: GESTIS
BCF - Fish [1]	0.0048 (Pisces, Literature study, Dry weight)
Partition coefficient n-octanol/water (Log Pow)	0.23 Source: SRC

12.2. Persistence and degradability

Silicon Metal (7440-21-3)	
Persistence and degradability	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

Copper (7440-50-8)	
Persistence and degradability	Biodegradability: not applicable.
Chemical oxygen demand (COD)	Not applicable
ThOD	Not applicable
BOD (% of ThOD)	Not applicable

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)

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

Chromium (7440-47-3)	
Persistence and degradability	Biodegradability: not applicable.
Chemical oxygen demand (COD)	Not applicable (inorganic)
ThOD	Not applicable (inorganic)

12.3. Bioaccumulative potential

Silicon Metal (7440-21-3)	
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.

Copper (7440-50-8)	
Partition coefficient n-octanol/water (Log Pow)	-0.57 Source: EPISUITE
Bioaccumulative potential	Bioaccumulation: not applicable.

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).

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.

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

Chromium (7440-47-3)	
BCF - Fish [1]	0.0048 (Pisces, Literature study, Dry weight)
Partition coefficient n-octanol/water (Log Pow)	0.23 Source: SRC
Bioaccumulative potential	Not bioaccumulative.

12.4. Mobility in soil

Silicon Metal (7440-21-3)	
Ecology - soil	Highly mobile in soil.

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

Copper (7440-50-8)	
Partition coefficient n-octanol/water (Log Pow)	-0.57 Source: EPISUITE
Ecology - soil	Adsorbs into the soil.

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

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

Chromium (7440-47-3)	
Surface tension	No data available (test not performed)
Partition coefficient n-octanol/water (Log Pow)	0.23 Source: SRC
Ecology - soil	No (test)data on mobility of the substance available.

12.5. Other adverse effects

Ozone : Not classified
Other adverse effects : No data available

13. Disposal considerations

13.1. Disposal method

Dispose of contents/container in accordance with licensed collector's sorting instructions.

13.2. Disposal precaution

No data available

14. Transport information

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 supplementary information 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	7440-21-3: Silicon 7439-96-5: Manganese&Inorganic compounds, as Mn 7440-50-8: Copper 7440-02-0: Nickel 7439-98-7: Molybdenum 7439-89-6: Iron salts (Soluble, as Fe) 7440-47-3: Chromium
Hazardous Substances Below Permissible Level	Applicable	7439-96-5: Manganese and its inorganic compounds 7440-02-0: Nickel and its insoluble inorganic compounds
Hazardous Substances Subject to Working Environment Measurement	Applicable	7439-96-5: Manganese and its inorganic compounds 7440-50-8: Copper 7440-02-0: Nickel and its inorganic compounds 7440-47-3: Chromium and its inorganic compounds
Hazardous Substances Subject to Workers Requiring Health Examination	Applicable	7439-96-5: Manganese and its inorganic compounds 7440-50-8: Copper 7440-02-0: Nickel and its inorganic compounds 7440-47-3: Chromium and its compounds
Hazardous Substances Subject to Control	Applicable	7439-96-5: Manganese and its inorganic compounds 7440-50-8: Copper and its compounds 7440-02-0: Nickel and its inorganic compounds 7439-89-6: Iron and its compounds 7440-47-3: Chromium and its compounds(except Chromium(VI) compounds)

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	(Class 2 Combustible solid - category 5 Metal powder (Designated quantity: 500kg); Class 2 Combustible solid - category 4 Iron Powder (Designated quantity: 500kg))
	Applicable	7440-21-3: Silicon powder (Class 2 Combustible solid - category 5 Metal 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)) 7439-89-6: Iron powder (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))

15.5. Wastes Control Act

Hazardous Substances in Designated wastes	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

International agreements

No data available

16. Other information

16.1. Data sources: 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),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,Supplier's safety documents,No data available,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,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.

16.2. Issue date: 11/3/2020

16.3. Revision number and date: 4.0, 16/02/2023

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.