# K-316LT

## Material Safety Data Sheet

In Accordance with MOEL Public notice No 2020-130
MSDS Number: AA06900-0000000311
Issue date: 6/28/1996 Revision date: 11/22/2021 Version: 6.0

## 1. Chemical product and company identification

### 1.1. Product identifier

| | | |
|---|---|---|
| Product form | : | Mixture |
| Trade name | : | K-316LT |
| Product code | : | KISWEL_MIX_94 |

### 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 - Repeated exposure, Category 1 | H372 |
| Specific target organ toxicity - Repeated exposure, Category 2 | H373 |

### 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.
H351 - Suspected of causing cancer.
H372 - Causes damage to organs through prolonged or repeated exposure.
H373 - May cause damage to organs through prolonged or repeated exposure.

### 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.
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.
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:**

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<br>KECI-No.: KE-21059 | 55 – 65 |
| Chromium | Chromium metal / Chromium, elemental / Chromium, metal / Chromium, metallic / Chrome, metal / Chrome | CAS-No.: 7440-47-3<br>KECI-No.: KE-05970 | 17 – 20 |
| Nickel | Nickel metal / Nickel, elemental / Nickel, metallic / Nickel, metal / C.I. 77775 | CAS-No.: 7440-02-0<br>KECI-No.: KE-25818 | 8 – 10 |
| 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<br>KECI-No.: KE-33900 | 5 – 7 |
| Molybdenum | Molybdenum metal / Molybdenum, elemental / Molybdenum, metal / Molybdenum, metallic / molybdenum | CAS-No.: 7439-98-7<br>KECI-No.: KE-25427 | 1 – 3 |

| Substance name | Other Names | Product identifier number | Concentration (%) |
|---|---|---|---|
| Manganese | Manganese, elemental / Manganese metal / manganese | CAS-No.: 7439-96-5<br>KECI-No.: KE-22999 | 1 – 2 |

## 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.

### 4.3. First-aid measures after inhalation

Remove person to fresh air and keep comfortable for breathing.

### 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.
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.

## 7. Handling and storage

### 7.1. Precautions for safe handling

Precautions for safe handling : Ensure good ventilation of the work station.
Wear personal protective equipment.
Do not breathe dust/fume/gas/mist/vapours/spray.

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

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

## 8. Exposure controls/personal protection

### 8.1. Occupational Exposure Limits

| K-316LT |
|---|
| No data available |

| 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)<br>5 mg/m³ (respirable dust) |
| OEL STEL | 10 mg/m³ (inhalable dust) |
| **Australia - Occupational Exposure Limits** | |
| OES TWA [1] | 10 mg/m³ (containing no asbestos and <1% crystalline silica-inhalable dust) |

| Titanium Dioxide (13463-67-7) | |
|---|---|
| **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)<br>0.3 mg/m³ (CIB 63-ultrafine, including engineered nanoscale) |
| **USA - OSHA - Occupational Exposure Limits** | |
| OSHA PEL TWA [1] | 15 mg/m³ (total dust) |

| 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 |

| 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<br>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)<br>0.02 mg/m³ (respirable particulate) |

| **Manganese (7439-96-5)** | |
|---|---|
| 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) |
| **USA - ACGIH - Occupational Exposure Limits** | |
| ACGIH OEL TWA | 0.02 mg/m³ (respirable particulate matter)<br>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) |

| **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 |

| **Nickel (7440-02-0)** | |
|---|---|
| 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] | 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 |

| **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 |

| Chromium (7440-47-3) | |
|---|---|
| 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 |

| Molybdenum (7439-98-7) | |
|---|---|
| **Korea - Occupational Exposure Limits** | |
| Local name | 몰리브덴 (불용성화합물) # Molybdenum (Insoluble compounds) |
| ISHA OEL TWA | 10 mg/m³ 흡입성 # (Inhalable fraction)<br>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)<br>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 insufficient ventilation, wear suitable respiratory equipment |

| **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

| 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 |

| 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)) |

| 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 |

| 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) |

| 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 |

| 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:**

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.

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

| 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:**

Not classified

**STOT-repeated exposure:**

Causes damage to organs through prolonged or repeated exposure. May cause 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. |

| 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. |

| 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

| K-316LT | |
|---|---|
| Viscosity, kinematic | Not applicable |

| 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) |

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

| 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) |
| Viscosity, dynamic | Not applicable (solid) |

| Chromium (7440-47-3) | |
|---|---|
| Density | 7.19 g/cm³ (at 20 °C) |

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

## 12. Ecological information

### 12.1. Ecotoxicity

Ecology - general : The product is not considered harmful to aquatic organisms nor to cause long-term adverse effects in the environment.

Hazardous to the aquatic environment, short–term (acute) : Not classified
Hazardous to the aquatic environment, long–term (chronic) : Not classified

| 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 |
| 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' |

| 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 |

| 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) |

| 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) |

| 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 |

| 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

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

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

| Manganese (7439-96-5) | |
|---|---|
| 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.<br>Biodegradability: not applicable. |
| Chemical oxygen demand (COD) | Not applicable (inorganic) |
| ThOD | Not applicable (inorganic) |

| Chromium (7440-47-3) | |
|---|---|
| Persistence and degradability | 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 |

### 12.3. Bioaccumulative potential

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

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

| 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. |

| 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). |

| 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. |

| 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

| Titanium Dioxide (13463-67-7) | |
|---|---|
| Surface tension | No data available in the literature |

| Titanium Dioxide (13463-67-7) | |
|---|---|
| Ecology - soil | Low potential for mobility in soil. |

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

| Manganese (7439-96-5) | |
|---|---|
| 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. |

| 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. |

| 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

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 |

| UN RTDG | ADR | IMDG | IATA |
|---|---|---|---|
| **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 | 13463-67-7: Titanium dioxide<br>7439-89-6: Iron salts (Soluble, as Fe)<br>7439-96-5: Manganese&Inorganic compounds, as Mn<br>7440-02-0: Nickel<br>7440-47-3: Chromium<br>7439-98-7: Molybdenum |
| Hazardous Substances Below Permissible Level | Applicable | 7439-96-5: Manganese and its inorganic compounds<br>7440-02-0: Nickel and its insoluble inorganic compounds |
| Hazardous Substances Subject to Working Environment Measurement | Applicable | 13463-67-7: Titanium dioxide<br>7439-96-5: Manganese and its inorganic compounds<br>7440-02-0: Nickel and its inorganic compounds<br>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<br>7440-02-0: Nickel and its inorganic compounds<br>7440-47-3: Chromium and its compounds |
| Hazardous Substances Subject to Control | Applicable | 13463-67-7: Titanium dioxide<br>7439-89-6: Iron and its compounds<br>7439-96-5: Manganese and its inorganic compounds<br>7440-02-0: Nickel and its inorganic compounds<br>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 4 Iron Powder (Designated quantity: 500kg); Class 2 Combustible solid - category 5 Metal powder (Designated quantity: 500kg)) |
| | Applicable | 7439-89-6: Iron powder<br>(Class 2 Combustible solid - category 4 Iron Powder (Designated quantity: 500kg))<br>7439-96-5: Manganese powder<br>(Class 2 Combustible solid - category 5 Metal powder (Designated quantity: 500kg))<br>7440-47-3: Chromium powder<br>(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

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:** 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,Supplier's safety documents,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,ECHA (European Chemicals Agency),No data available,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 KOSHA, NITE, ESIS, NLM, SIDS, IPCS, NCIS, etc.

**16.2. Issue date:** 6/28/1996

**16.3. Revision number and date:** 6.0, 22/11/2021

**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.