

Document No.	MSDS-35	Revision Ver.	2
Writing Department	QM	Reviton date	2022.04.04

# Material Safety Data Sheet

[This sheet was made by Industrial Safety and Health Act, Article 41, in Korea]

## Hot Dip Zn–Al–Mg Alloy Coated Steel Sheet(MgCOT)



## 1. Chemical Product and Company Identification

A. Product Name : Hot Dip Zn-Al-Mg Alloy Coated Steel Sheet(MgCOT)

B. Recommended Use of Product and restrictions on use

Recommended Use of Product : Home appliance etc  
restrictions on use : N/A

C. Manufacturer / Supplier / Distributor Information

Name: KG Steel

Address : 1228, Bukbusaneom-ro, Songak-Eup, Dangjin-Si, Chungnam province,  
343-823, Korea

- Emergency phone number : +82-41-351-8527 / +82-41-351-8115

## 2. Hazards Identification

A. Hazard. Risk Classification

Water-reactive substances and mixtures : Classification 1

Pyrophoric solid : Classification 1

Reproductive toxicity : Classification 1B

Chronic aquatic environment hazard : Classification 3

B. Label elements including precautionary statements

Symbol



Signal Word : Hazards

Hazard-Risk Statement

H360 May damage fertility or the unborn child

H411 Toxic to aquatic life with long lasting effects

Precautionary Statement

Prevention

P201 Obtain special instructions before use

P202 Do not handle until all safety precautions have been read and understood

P273 Avoid release to the environment

P280 Wear protective gloves/protective clothing/eye protection/face protection

Response

P308+P313 If exposed or concerned : Get medical advice / attention

P391 Collect spillage

Storage

P405 Store locked up

Disuse

P501 Dispose of contents in accordance with international regulation

C. Other Hazard. Risk which are not included in the classification criteria

Magnesium

Health : 0      Fire : 1                  Reaction : 2

Aluminum

Health : 0      Fire : N/A                  Reaction : 1

Manganese

Health : 0      Fire : N/A                  Reaction : 1

Iron

Health : 2      Fire : N/A                  Reaction : N/A

Zinc

Health : 0      Fire : N/A                  Reaction : 1

### 3. Composition/Information on ingredients

Name	Other name	CAS No.	Percentage
Magnesium	Magnesium	7439-95-4	Max 0.10%
Aluminum	Aluminium	7429-90-5	Max 0.30%
Manganese	Mangan	7439-96-5	Max 1.00%
Iron	Ferrium	7439-89-6	Max 98.24%
Zinc	Zink	7440-66-6	Max 1.20%

※ Please refer to the MSDS of iron

- ※ C, Si and Ti may be added in minor amounts during manufacturing
- ※ This product is solid finished product. There is no possibility of exposure to chemicals contained in the product. It may be partially exposed in the melting state such as cutting, melting etc.

#### 4. First aid measures

##### A. Eye contact

Get medical advice/attention

Rinse cautiously with water for several minutes.

##### B. Skin contact

Get medical advice/attention

Remove contaminated clothing and shoes and isolate contaminated areas

Rinse cautiously with water for several minutes

Avoid dispersal of contaminants.

Brush off loose particles from skin. Immerse in cool water or wrap in wet bandages

##### C. Inhalation

If exposed or concerned : Get medical advice/ attention

Remove person to fresh air

Make it warm and stable

##### D. Ingestion

Do not use artificial respiration with mouth-to-mouth method and use appropriate respiratory medical equipment

##### E. Doctor's notes

Contact your health care professional and take special first aid measures such as follow-up investigations

Have the healthcare worker know about the material and take protective measures

#### 5. Fire-Fighting measures

##### A. Suitable (and unsuitable) extinguishing media

Use alcohol foam, carbon dioxide or water spray

Use dry sand or soil for extinguishment by smothering

B. Specific hazards arising from the chemical

Can generate toxic gas by decomposing at high temperature

Some can burn, but not easily ignite

Non-flammable materials do not burn, but can generate corrosive/toxic fumes by decomposing at high temperatures.

Some may generate flammable hydrogen gas on contact with metal.

C. Special protective equipment and precautions for fire-fighters

Magnesium

Rescuers should wear appropriate protective equipment

Escape the area and extinguish the fire at a safe distance

Do not let water get inside the container.

Aluminum

Escape the area and extinguish the fire at a safe distance

Do not let water get inside the container.

Manganese

Rescuers should wear appropriate protective equipment

Escape the area and extinguish the fire at a safe distance

Move container from fire area if it is not hazardous

If it is impossible to extinguish the fire, protect the surroundings and let the fire extinguish itself

Iron

Move container from fire area if it is not hazardous

Do not let water get inside the container.

Zinc

Rescuers should wear appropriate protective equipment

Escape the area and extinguish the fire at a safe distance

Do not let water get inside the container.

## 6. Accidental release measures

- A. Personal precautions, protective equipment and emergency procedures
  - isolate contaminated areas
  - Do not enter if you do not need to enter or do not have protective equipment
  - Stop the leak if it is not dangerous
  - Do not touch a damaged container or spill without adequate protection
  - Avoid dust formation
  - Note the substances and conditions to avoid
- B. Environmental precautions and protective procedures
  - Do not discharge into the environment
  - Prevent entry into waterways and sewers.
- C. Methods and materials for containment and cleaning up
  - Cover with plastic sheet to prevent spreading
  - In case of powder leakage, cover with plastic sheet to prevent spread and keep dry
  - In case of small spills, absorb with sand and non-combustible material

## 7. Handling and storage

- A. Precautions for safe handling
  - Do not apply pressure, cut, weld, solder, join, swab or grind or exposure to heat, flames, sparks, static electricity, or other sources of ignition.
  - Note the substances and conditions to avoid
  - Be careful of high temperatures
  - Avoid contact with water.
- B. Conditions for safe storage
  - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources
  - Store in a dry place
  - Keep in a tightly closed container

## 8. Exposure controls & personal protection

### A. Control parameters

#### Domestic regulations

Magnesium : N/A

Aluminum : TWA : 2mg/m<sup>3</sup> Aluminium(Soluble salt)

TWA : 10mg/m<sup>3</sup> Aluminium(metal dust)

TWA : 2mg/m<sup>3</sup> Aluminium (alkyl)

TWA : 5mg/m<sup>3</sup> Aluminium (welding fume)

TWA : 5mg/m<sup>3</sup> Aluminium (Pyro powder)

Manganese : TWA – 1mg/m<sup>3</sup> Manganese and inorganic compounds

TWA – 1mg/m<sup>3</sup> STEL - 3mg/m<sup>3</sup> Manganese(fume)

Iron : TWA – 1mg/m<sup>3</sup>

Zinc : N/A

#### ACGIH

Magnesium: N/A

Aluminum : TWA 1 mg/m<sup>3</sup>

Manganese : TWA (inhalable) 0.1mg/m<sup>3</sup>, (respirable) 0.02 mg/m<sup>3</sup>

Iron : N/A

Zinc: N/A

#### Biological exposure standard

Magnesium: N/A

Aluminum : N/A

Manganese : N/A

Iron : N/A

Zinc : N/A

#### Other exposure standard

Magnesium: N/A

Aluminum : N/A

Manganese : N/A

Iron : N/A

Zinc : N/A

B. Appropriate engineering controls

Use process isolation, local exhaust, or keep air level below exposure standard

C. Personal protective equipment

Respiratory protection

Magnesium

Wear respiratory protection which has been approved by the Korean Occupational Safety and Health Administration in accordance with physicochemical properties of the particulate matter to be exposed.

The following respiratory protection is recommended for particulate matter - Face-to-face dust mask or air-entrainment dust mask (high-efficiency particulate filter) or electric fan-attached dust mask (dust, mist, fume filter medium).

If oxygen is lacking (19.6%), wear a breathing mask or self-contained breathing apparatus.

Aluminium(Soluble salt)

Wear respiratory protection which has been approved by the Korean Occupational Safety and Health Administration in accordance with physicochemical properties of the particulate matter to be exposed.

If the exposure level is lower than  $20\text{mg}/\text{m}^3$ , wear a respiratory protective gear of half mask type that have appropriate type filter.

If the exposure concentration is lower than  $50\text{mg}/\text{m}^3$ , wear a dust mask of loose-fitting hood /powered helmet type or continuous-flow type that have appropriate type filter.

If the exposure concentration is lower than  $100\text{mg}/\text{m}^3$ , wear a respiratory protective gear of full type or powered and half type or Air-fed continuous-flow / pressure-demanding type that have appropriate type filter.

If the exposure concentration is lower than  $2000\text{mg}/\text{m}^3$ , wear a ventilation mask of full type or hood/helmet type or Pressure-demanded type that have appropriate type filter.

If the exposure concentration is lower than  $20000\text{mg}/\text{m}^3$ , wear self-contained breathing apparatus (SCBA) or self-contained breathing apparatus with pressure-demand self-contained breathing apparatus (SCBA) with appropriate filter.



## Aluminium(metal dust)

Wear respiratory protection which has been approved by the Korean Occupational Safety and Health Administration in accordance with physicochemical properties of the particulate matter to be exposed.

If the exposure level is lower than  $100\text{mg}/\text{m}^3$ , wear a respiratory protective gear of half mask type that have appropriate type filter.

If the exposure concentration is lower than  $250\text{mg}/\text{m}^3$ , wear a dust mask of loose-fitting hood /powered helmet type or continuous-flow type that have appropriate type filter.

If the exposure concentration is lower than  $500\text{mg}/\text{m}^3$ , wear a respiratory protective gear of full type or powered and half type or Air-fed continuous-flow / pressure-demanding type that have appropriate type filter.

If the exposure concentration is lower than  $10000\text{mg}/\text{m}^3$ , wear a ventilation mask of full type or hood/helmet type or Pressure-demanded type that have appropriate type filter.

If the exposure concentration is lower than  $100000\text{mg}/\text{m}^3$ , wear self-contained breathing apparatus (SCBA) or self-contained breathing apparatus with pressure-demand self-contained breathing apparatus (SCBA) with appropriate filter.

## Aluminium (alkyl)

Wear respiratory protection which has been approved by the Korean Occupational Safety and Health Administration in accordance with physicochemical properties of the particulate matter to be exposed.

If the exposure level is lower than  $20\text{mg}/\text{m}^3$ , wear a respiratory protective gear of half mask type that have appropriate type filter.

If the exposure concentration is lower than  $50\text{mg}/\text{m}^3$ , wear a dust mask of loose-fitting hood /powered helmet type or continuous-flow type that have appropriate type filter.

If the exposure concentration is lower than  $100\text{mg}/\text{m}^3$ , wear a respiratory protective gear of full type or powered and half type or Air-fed continuous-flow / pressure-demanding type that have appropriate type filter.

If the exposure concentration is lower than  $2000\text{mg}/\text{m}^3$ , wear a ventilation mask of full type or hood/helmet type or Pressure-demanded type that have appropriate type filter.

If the exposure concentration is lower than  $20000\text{mg}/\text{m}^3$ , wear self-contained breathing apparatus (SCBA) or self-contained breathing apparatus with pressure-demand self-contained breathing apparatus (SCBA) with appropriate filter.

#### Aluminium (welding fume)

Wear respiratory protection which has been approved by the Korean Occupational Safety and Health Administration in accordance with physicochemical properties of the particulate matter to be exposed.

If the exposure level is lower than  $50\text{mg}/\text{m}^3$ , wear a respiratory protective gear of half mask type that have appropriate type filter.

If the exposure concentration is lower than  $125\text{mg}/\text{m}^3$ , wear a dust mask of loose-fitting hood /powered helmet type or continuous-flow type that have appropriate type filter.

If the exposure concentration is lower than  $250\text{mg}/\text{m}^3$ , wear a respiratory protective gear of full type or powered and half type or Air-fed continuous-flow / pressure-demanding type that have appropriate type filter.

If the exposure concentration is lower than  $5000\text{mg}/\text{m}^3$ , wear a ventilation mask of full type or hood/helmet type or Pressure-demanded type that have appropriate type filter.

If the exposure concentration is lower than  $50000\text{mg}/\text{m}^3$ , wear self-contained breathing apparatus (SCBA) or self-contained breathing apparatus with pressure-demand self-contained breathing apparatus (SCBA) with appropriate filter.

#### Aluminium (Pyro powder)

Wear respiratory protection which has been approved by the Korean Occupational Safety and Health Administration in accordance with physicochemical properties of the particulate matter to be exposed.

If the exposure level is lower than  $50\text{mg}/\text{m}^3$ , wear a respiratory protective gear of half mask type that have appropriate type filter.

If the exposure concentration is lower than  $125\text{mg}/\text{m}^3$ , wear a dust mask of loose-fitting hood /powered helmet type or continuous-flow type that have appropriate type filter.

If the exposure concentration is lower than  $250\text{mg}/\text{m}^3$ , wear a respiratory protective gear of full type or powered and half type or Air-fed continuous-flow / pressure-demanding type that have appropriate type filter.

If the exposure concentration is lower than  $5000\text{mg}/\text{m}^3$ , wear a ventilation mask of full type or hood/helmet type or Pressure-demanded type that have appropriate type filter.

If the exposure concentration is lower than  $50000\text{mg}/\text{m}^3$ , wear self-contained breathing apparatus (SCBA) or self-contained breathing apparatus with pressure-demand self-contained breathing apparatus (SCBA) with appropriate filter.

#### Manganese and inorganic compounds

Wear respiratory protection which has been approved by the Korean Occupational Safety and Health Administration in accordance with physicochemical properties of the particulate matter to be exposed.

If the exposure level is lower than  $10\text{mg}/\text{m}^3$ , wear a respiratory protective gear of half mask type that have appropriate type filter.

If the exposure concentration is lower than  $25\text{mg}/\text{m}^3$ , wear a dust mask of loose-fitting hood /powered helmet type or continuous-flow type that have appropriate type filter.

If the exposure concentration is lower than  $50\text{mg}/\text{m}^3$ , wear a respiratory protective gear of full type or powered and half type or Air-fed continuous-flow / pressure-demanding type that have appropriate type filter.

If the exposure concentration is lower than  $1000\text{mg}/\text{m}^3$ , wear a ventilation mask of full type or hood/helmet type or Pressure-demanded type that have appropriate type filter.

If the exposure concentration is lower than  $10000\text{mg}/\text{m}^3$ , wear self-contained breathing apparatus (SCBA) or self-contained breathing apparatus with pressure-demand self-contained breathing apparatus (SCBA) with appropriate filter.

## Manganese (fume)

Wear respiratory protection which has been approved by the Korean Occupational Safety and Health Administration in accordance with physicochemical properties of the particulate matter to be exposed.

If the exposure level is lower than  $30\text{mg}/\text{m}^3$ , wear a respiratory protective gear of half mask type that have appropriate type filter.

If the exposure concentration is lower than  $75\text{mg}/\text{m}^3$ , wear a dust mask of loose-fitting hood /powered helmet type or continuous-flow type that have appropriate type filter.

If the exposure concentration is lower than  $150\text{mg}/\text{m}^3$ , wear a respiratory protective gear of full type or powered and half type or Air-fed continuous-flow / pressure-demanding type that have appropriate type filter.

If the exposure concentration is lower than  $3000\text{mg}/\text{m}^3$ , wear a ventilation mask of full type or hood/helmet type or Pressure-demanded type that have appropriate type filter.

If the exposure concentration is lower than  $30000\text{mg}/\text{m}^3$ , wear self-contained breathing apparatus (SCBA) or self-contained breathing apparatus with pressure-demand self-contained breathing apparatus (SCBA) with appropriate filter.

## Iron

Wear respiratory protection which has been approved by the Korean Occupational Safety and Health Administration in accordance with physicochemical properties of the particulate matter to be exposed.

If the exposure level is lower than  $10\text{mg}/\text{m}^3$ , wear a respiratory protective gear of half mask type that have appropriate type filter.

If the exposure concentration is lower than  $25\text{mg}/\text{m}^3$ , wear a dust mask of loose-fitting hood /powered helmet type or continuous-flow type that have appropriate type filter.

If the exposure concentration is lower than  $50\text{mg}/\text{m}^3$ , wear a respiratory protective gear of full type or powered and half type or Air-fed continuous-flow / pressure-demanding type that have appropriate type filter.

If the exposure concentration is lower than  $1000\text{mg}/\text{m}^3$ , wear a ventilation mask of full type or hood/helmet type or Pressure-demanded type that have appropriate type filter.

If the exposure concentration is lower than  $10000\text{mg}/\text{m}^3$ , wear self-contained breathing apparatus (SCBA) or self-contained breathing apparatus with pressure-demand self-contained breathing apparatus (SCBA) with appropriate filter.

Zinc

Wear respiratory protection which has been approved by the Korean Occupational Safety and Health Administration in accordance with physicochemical properties of the particulate matter to be exposed.

Eye protection : N/A

Hands protection : N/A

Body protection : N/A

## 9. Physical and chemical properties

Magnesium

A. Appearance

Appearance : Solid(Powder)

Colour : Gray

B. Odour : Odorless

C. Odour threshold : N/A

D. pH : N/A

E. Melting point/freezing point :  $651^\circ\text{C}$

F. Initial boiling point and boiling range :  $1100^\circ\text{C}$

G. Flash point : N/A

H. Evaporation rate : N/A

I. Flammability(solid, gas) : N/A

J. Upper/lower flammability or explosive limits : -/- ( $0.03\text{kg}/\text{m}^3$ (하한))

K. Vapour pressure : ( $4.24\text{E}-09$  mmHg at  $25^\circ\text{C}$  (추정치))

L. Solubility :  $32.5\text{g}/100\text{mL}$  ( $25^\circ\text{C}$  (추정치))

- M. Vapor density : N/A
- N. Specific gravity : 1.7
- O. N-octanol/water Partition coefficient : -0.57 (추정치)
- P. Auto-ignition temperature : 473°C
- Q. Decomposition temperature : N/A
- R. Viscosity : N/A
- S. Molecular weight : 24.3

#### Aluminum

- A. Appearance
  - Appearance : Solid(Powder)
  - Colour : Sliver white~Gray
- B. Odour : Odorless
- C. Odour threshold : N/A
- D. pH : N/A
- E. Meting point/freezing point : 660°C
- F. Initial boiling point and boiling range : 2327°C
- G. Flash point : N/A
- H. Evaporation rate : N/A
- I. Flammability(solid, gas) : N/A
- J. Upper/lower flammability or explosive limits : N/A
- K. Vapour pressure : N/A
- L. Solubility : (Insoluble)
- M. Vapor density : N/A
- N. Specific gravity : 2.7
- O. N-octanol/water Partition coefficient : N/A
- P. Auto-ignition temperature : 590°C
- Q. Decomposition temperature : N/A
- R. Viscosity : N/A
- S. Molecular weight : 26.98

## Manganese

### A. Appearance

Appearance : Solid(Powder)

Colour : Gray

### B. Odour : N/A

### C. Odour threshold : N/A

### D. pH : N/A

### E. Melting point/freezing point : 1244°C

### F. Initial boiling point and boiling range : Aluminum : 1962°C

### G. Flash point : N/A

### H. Evaporation rate : N/A

### I. Flammability(solid, gas) : Flammability

J. Upper/lower flammability or explosive limits : N/A

### K. Vapour pressure : 1 Pa (955°C)

### L. Solubility : (Insoluble)

### M. Vapor density : N/A

### N. Specific gravity : 7.47

### O. N-octanol/water Partition coefficient : N/A

### P. Auto-ignition temperature : N/A

### Q. Decomposition temperature : N/A

### R. Viscosity : N/A

### S. Molecular weight : 54.94

## Iron

### A. Appearance

Appearance : Solid

Colour : White or Gray

### B. Odour : N/A

### C. Odour threshold : N/A

### D. pH : N/A

### E. Melting point/freezing point : 1535°C

- F. Initial boiling point and boiling range: 2750°C
- G. Flash point : None
- H. Evaporation rate : None
- I. Flammability(solid, gas) : None
- J. Upper/lower flammability or explosive limits : None
- K. Vapour pressure : 1 mmHg (at 1787°C)
- L. Solubility : (Water solubility: Insolubility. Solvent availability : availability : acid.  
Insolubility : alkali, Alcohol, ether)
- M. Vapor density : None
- N. Specific gravity : 7.86 ((water=1))
- O. N-octanol/water Partition coefficient : None
- P. Auto-ignition temperature : None
- Q. Decomposition temperature : None
- R. Viscosity : None
- S. Molecular weight : 55.85

## Zinc

- A. Appearance  
Appearance : Solid(Powder)  
Colour Gray ~ Blue
- B. Odour : Odorless
- C. Odour threshold : N/A
- D. pH : N/A
- E. Melting point/freezing point : 419°C
- F. Initial boiling point and boiling range : 907°C
- G. Flash point : N/A
- H. Evaporation rate : N/A
- I. Flammability(solid, gas) : Flammability
- J. Upper/lower flammability or explosive limits : N/A
- K. Vapour pressure : 0.1 kPa (487°C)
- L. Solubility : (Reaction)
- M. Vapor density : N/A`



- N. Specific gravity : 7.14 (Water=1)
- O. N-octanol/water Partition coefficient : -0.47 (Estimate)
- P. Auto-ignition temperature : 460°C (Fine powder)
- Q. Decomposition temperature : N/A
- R. Viscosity : N/A
- S. Molecular weight : 65.38

## 10. Stability and reactivity

### A. Chemical stability and possibility of hazardous reactions

#### Magnesium

Self-igniting when exposed to air

Contact with water generates flammable gas that can spontaneously ignite

Avoid contact with water as it may cause severe reaction and fire

Leaks may present a fire / explosion hazard

Unstable at room temperature

Generates flammable gas on contact with water.

May re-ignite after extinguish the fire

Can be ignited by heat, sparks and flames

May cause irritation, corrosive and toxic gases in case of fire

Inhalation and contact with vapors, substance and decomposition products may cause serious injur or death

May form corrosive solution in contact with water

Some react vigorously with water

#### Aluminum

Leaks are a fire / explosion hazard

May ignite on contact with water or moist air

Can be re-ignited after extinguish the fire

Can be ignited by heat, spark, flame

Ingalation and contact with vapors, substances and decomposition products may cause serious injury or death

May form corrosive solution in contact with water

Some react vigorously with water

#### Manganese

Can decompose at high temperature to produce toxic gas

Container may explode on heating

Can be ignited by friction, heat, spark, flame

Can be re-ignited after extinguish the fire

Some materials burn with intense heat

Dust, fume may form explosive mixture with air

Inhalation and contact with vapors, substances and decomposition products may cause serious injury or death

Oxide in metal fires show serious health hazards

#### Iron

Container may explode on heating

Leaks are a fire / explosion hazard

Can be re-ignited after extinguish the fire

Some materials flash quickly and can burn

Inhalation of decomposition products may lead to serious injury or death

May cause irritating, corrosive and toxic gases in case of fire

#### Zinc

Self ignited when exposed to air

Leaks are a fire / explosion hazard

Generate flammable gas on contact with water

Can be re-ignited after extinguish the fire

Can be ignited by heat, spark, flame

May cause irritating, corrosive and toxic gases in case of fire

Inhalation and contact with vapors, substance and decomposition products may cause serious injury or death

May form corrosive solution in contact with water

B. Conditions to avoid

Magnesium: Keep away from heat, sparks, flame – no smoking

Moisture

Aluminum : Moisture/ Heat, spark, flame etc.

Manganese: Friction, heat, spark, flame

Iron : Friction, heat, spark, flame

Zinc : Keep away from heat, sparks, flame

Moisture

C. Incompatible materials

Magnesium: handle under inactive gas and avoid moisture

Aluminum : Water

Manganese: Water

Iron: Water

Zinc: Water

D. Hazardous decomposition products

Magnesium: During burning, pyrolysis or combustion can produce irritating and highly toxic gases

Aluminum , Manganese, Iron, Zinc : irritant, corrosive, toxic gas

## 11. Toxicological information

A. Information on the likely routes of exposure

Magnesium: May cause irritation, metallic fumes and heat

May cause vomiting, diarrhea and stomach pain

May cause irritation and skin irritation

May cause irritation

Aluminum, Manganese, Iron, Zinc : N/A

B. Health hazards information

Acute toxic

Oral

Magnesium : N/A

Aluminum : LD50 > 15900 mg/kg Rat (OECD TG 401)

Maganese : LD50 > 2000 mg/kg Rat (OECD TG 420, GLP)

Iron : LD50 98600 mg/kg Rat (OECD TG 101 Male)

Zinc : LD50 > 2000 mg/kg (OECD TG 401, GLP)

#### Dermal

Magnesium : N/A

Aluminum : N/A

Manganese: N/A

Iron : LD50 20000 mg/kg Guinea pig

Zinc : N/A

#### Inhalation

Magnesium : N/A

Aluminum : Dust LC50 > 0.888 mg/l 4 hr Rat (OECD TG 403, GLP)

Manganese : Dust LC50 > 5.14 mg/l 4 hr Rat (OECD TG 403, GLP)

Iron : Dust LC50 > 100 mg/m<sup>3</sup> 6 hr Rat (Not applicable to classification due to lack of reliability of data such as mouse, hamster and guinea pig)

Zinc : Dust LC50 > 5.41 mg/m<sup>3</sup> 4 hr Rat (OECD TG 403, GLP)

#### Skin corrosive/irritant

Magnesium : Skin, Eye irritaion report

Aluminum : As a result of skin corrosion / irritation test on rabbits, no corrosivity  
Similar materials : aluminium oxide TBH OECD TG 404, GLP

Manganese : As a result of skin corrosion / irritation test on rabbits, no corrosivity  
OECD TG 404, GLP

Iron : As a result of skin corrosion / irritation test on rabbits, no corrosivity  
OECD TG 404

Zinc : Body/No stimulation

#### Serious eye damage/eye irritation

Magnesium : Skin, Eye irritaion report

Aluminum : As a result of eye damage / irritation test on rabbits, no stimulation  
Similar materials : aluminium oxide TBH FDA of the United States

Manganese : As a result of eye damage / irritation test on rabbits, no stimulation  
OECD TG 405, GLP

Iron : As a result of eye damage / irritation test on rabbits, no stimulation  
OECD TG 405

Zinc : As a result of eye damage / irritation test on rabbits, very slight irritation,  
but not classified OECD TG 405, GLP

#### Respiratory sensitization

Magnesium : N/A

Aluminum : As a result of respiratory sensitization test for male mouse,  
no sensitization (Similar materials : aluminium oxide)

Manganese : N/A

Iron : N/A

Zinc : N/A

#### Skin sensitization

Magnesium : N/A

Aluminum : As a result of the skin irritability test for male guinea pigs, nosensitization  
Similar materials : aluminium oxide AK 43/79 and aluminium oxide AK 44/79

Manganese : : As a result of the skin sensitization LLNA test for female mouse,  
no sensitization OECD TG 426, GLP

Iron : As a result of the skin sensitization test for guinea pigs,  
all iron oxide materials are non-irritant

Similar materials : 1309-37-1, 1317-61-9, 1310-14-1

Zinc : No skin sensitization

#### Carcinogenicity

Industrial Safety and Health Act : N/A

Ministry of Labor examination : N/A

IARC : N/A

OSHA : N/A

ACGIH

Magnesium : N/A

Aluminum : A4(Aluminium metal and insolubte compounds)

Manganese : A4

Iron : N/A

Zinc : N/A

NTP : N/A

EU CLP : N/A

#### Germ cell Mutagenicity

Magnesium : N/A

Aluminum : As a result of DNA damage test in vitro, if there is no metabolic active system, it is negative Similar materials :  $AlCl_3$  obtained from Sigma, As a result of chromosome aberration test using in vivo mammalian bone marrow cells, if there is no metabolic active system, it is negative Similar materials :  $AlCl_3$  obtained from Sigma OECD TG 475 Aluminum causes a change in concentration-dependent biomes in the sister chromosome number and increases the pre-planned DNA integration.

Manganese: : As a result of chromosomal aberration test using in vitro cultured mammalian cells, no chromosomal animalies

Similar materials : 7773-01-5 OECD TG 473, GLP

Iron : As a result of gene mutation test using in vitro cultured mammalian cels, carbonyl iron is positive and electrolytic iron is negative OECD TG 476

Zinc : As a result of genetic mutation test by in vitro mitotic recombination, negative Similar materials : 7733-02-0

#### Reproductive toxicity

Magnesium : N/A

Aluminum : As a result of oral toxicity test on rats, NOAEL = 266 mg/kg bw/day (OECD TG 414)

As a result of developmental and reproductive toxicity tests on pregnant rats, the fetus was removed between 6 and 18 days

Manganese : As a result of the teratogenicity test in mice, embryo lethality and malformed fetus (brain escape) occurred.

Reproductive toxicity expected

Iron : N/A

Zinc : : As a result of second generation oral toxicity test using rats, There was a significant effect on sex maturation, mating pregnancy and early lactation of adult rats, but, no significant effect on reproductive toxicity was observed

NOAEL = 7.5 mg/kg bw/day(F1)

(Similar materials : Zinc chloride) (OECD TG 416)

Specific target organ toxicity(Single exposure)

Magnesium : Irritate respiratory, lung or airways

Aluminum : Inhalation of material may result in bubbly emphysema, bronchopneumonia and bleeding

In addition, Concentration of interstitial tissue progresses in liver, brain and spleen

Inhalation of substance worsens pulmonary tuberculosis

Be insufficient to classify due to toxic effect and lack of reliable data

manganese : causes pneumonia

Iron : N/A

zinc : N/A

Specific target organ toxicity(Repeated exposure)

Magnesium : N/A

Aluminum: As a result of oral target organ systemic toxicity test using male rats,

NOAEL = 302 mg/kg diet

Similar materials : aluminium hydroxide OECD TG 407

Repeated, long-term lung exposure affect the nervous system

As a result of inhalation target organ systemic toxicity test using rats,

LOAEC = 50mg/m<sup>3</sup> air

Similar materials : Al powder OECD TG 413

Inhalation of the substance affects the central nervous system

As a result, the function is impaired

As a result of eating aluminum for 6 months in rats, aluminum concentration increased in bone, liver and kidney.

The change occurs especially in the kidneys and brain

Manganese : Influences respiratory and nervous system

As a result of repeated inhalation toxicity test for monkeys for 10 months, There is a toxic effect on pulmonary vascular lymphatic proliferation, interstitial lung accumulation, pulmonary necrosis with dust, appearance of bronchial secretions, hyperplastic lung wall, emphysema, and atelectasis NOAEL = 0.7 mg/m<sup>3</sup>

Iron : As a result of oral target organ systemic toxicity test on rats, the liver are affected

As a result of inhalation target organ systemic toxicity test on rats, NOAEC = 5mg/m<sup>3</sup>

Zinc : Oral repeated long term systemic toxicity test on mouse, Animals at very high concentrations showed low food intake, growth retardation, histopathological lesions and proliferation of red cell immature cells.

NOEL = 3,000 ppm Similar materials : 7733-02-0 OECD TG 408

Aspiration hazard : N/A

Other harmful effects : N/A

## 12. Ministry of Labor examination

### A. Ecotoxicity

Fish

Magnesium: N/A

Aluminum : N/A

Manganese : LC50 > 3.6 mg/l 96 hr *Oncorhynchus mykiss* (OECD Guideline 203, GLP)

Iron : LC50 13.6 mg/l 96 hr (*Danio rerio*, LC0, 96h, < 100,000mg/L,

Similar materials : 51274-00-1, OECD Guideline 203, *Brachydanio rerio*, LL0, LC50, 96h, >10,000mg/L, Similar materials : 1317-61-9)



Zinc : EC50 0.416 mg/l 48 hr Ceriodaphnia dubia (OECD TG 202)

#### Crustacea

Magnesium : LC50 64.7 ml 96 hr Gammarus lacustris

Aluminum : NOEC > 100 mg/l 48 hr Daphnia magna

Manganese : EC50 > 1.6 mg/l 48 hr Daphnia magna (OECD TG 202, GLP)

Iron : EC50 > 100 mg/l 48 hr Daphnia magna (Similar materials CAS No. 1309-37-1  
OECD TG 202)

Zinc : EC50 0.416 mg/l 48 hr Ceriodaphnia dubia (OECD TG 202)

#### Algae

Magnesium : N/A

Aluminum : NOEC  $\geq$  0.052 mg/l 72 hr selenastrum capricornutum (OECD TG 201, GLP)

Manganese : EC50 4.5mg/l 72 hr Other (test species : Desmodesmus subspicatus,  
OECD TG 201, GLP)

Iron : N/A

Zinc : NOEC 0.05 mg/l 72 hr Selenastrum capricornutum (OECD TG 201, GLP)

### B. Persistence and degradability

#### Persistence

Magnesium : log Kow -0.57 (Estimate)

Aluminum, Manganese, Iron, Zinc: N/A

Degradability : N/A

### C. Bioaccumulative potential

#### Bioaccumulation

Magnesium : N/A

Aluminum : N/A

Manganese : BCF  $\leq$  81

Iron : N/A

Zinc: 600 (Fish)

#### Biodegradable

Magnesium : N/A

Aluminum : N/A

Manganese : N/A

Iron : N/A

Zinc : (Not applicable to biodegradability test)

D. Mobility in soil : N/A

E. Other adverse effects

Magnesium : N/A

Aluminum : Crustacea Daphnia magna : NOEC = 0.076 mg/L reproduction, 0.137 mg/L immobilisation 21d OECD TG 211, GLP

Manganese : Crustacea Ceriodaphnia dubia : NOEC = 1.7 mg/L 8d OECD TG 211, GLP

Fish Oncorhynchus mykiss : NOEC = 0.77 mg/L 100d

Algae Ditylum brightwellii : EC50 = .5 mg/L 5d

Iron : N/A

Zinc : Fish Cottus bairdii : NOEC = 0.169 – 0.172 mg/L 30d

Crustacea Daphnia magna : NOEC = 0.048 – 0.156 mg/L 21d

Similar materials CAS No. 7646-85-7 OECD TG 211

Algae Ceramium tenuicorne : NOEC = 7.2 – 18 µg/L 7d

### 13. Disposal considerations

A. Disposal method

Magnesium : Dispose of contents in accordance with local regulation

Aluminum

- 1) Treat with neutralization, hydrolysis, oxidation and reduction.
- 2) Incinerate at high temperature or melt at high temperature.
- 3) Solidify

Manganese : N/A

Iron

Use one of the following methods

1. Solidify
2. Land a designated waste in a managed landfill

3. Incinerate spent catalysts containing flammable materials
4. In case of incinerating waste catalyst containing halogenated material, incinerate at high temperature

Zinc : N/A

B. Disposal precaution

Dispose of contents in accordance with international regulation

## 14. Transport information

A. UN Number (UN No.)

Magnesium : 1418

Aluminum : 1396

Manganese : 3089

Iron : 3089

Zinc : 1436

B. UN proper shipping name

Magnesium : Magnesium powder or Magnesium alloys powder

Aluminum : Aluminum powder, Uncoated

Manganese : Metal powder, Flammable, N.O.S.

Iron : METAL POWDER, Flammable, N.O.S.

Zinc : Zinc powder or Zinc dust

C. Transport hazard

Magnesium : 4.3

Aluminum : 4.3

Manganese : 4.1

Iron : 4.1

Zinc : 4.3

D. Packing group

Magnesium : II

Aluminum : II

Manganese : II

Iron : II

Zinc : I

E. Environmental hazards

Magnesium : N/A

Aluminum : Applicable

Manganese : Not applicable

Iron : Not Applicable

Zinc : Applicable(MP)

F. Special safety measures that the user needs or needs to know about transport

Emergency measures in case of fire

Magnesium F-G

Aluminum F-G

Manganese F-G

Iron F-G

Zinc F-G

Emergency measures in case of leak

Magnesium S-O

Aluminum S-O

Manganese : S-G

Iron : S-G

Zinc S-O

## 15. Regulatory information

A. Industrial Safety and Health Act

Magnesium : N/A

Aluminum : Toxic substances to be controlled

Working environment measured material (Measurement Cycle: 6 months)

Substances subject to special medical examination

(Diagnostic Cycle : 12 months)

Exposure standard setting substance

Manganese : Toxic substances to be controlled  
Special medical examination subject substance  
(diagnosis period: 12 months)  
Exposure standard setting substance

Iron : Toxic substances to be controlled  
Exposure standard setting substance

Zinc : Toxic substances to be controlled

B. Toxic Chemical Control Act : N/A

C. Dangerous Material Safety Control Act

Magnesium : Class 2 Magnesium 500kg

Aluminum : Class 2 Metal powder 500kg

Manganese : Class 2 Metal powder 500kg

Iron : Class 2 Iron powder 500kg

Zinc : Class 2 Metal powder 500kg

D. Wastes Management Act

Magnesium: N/A

Aluminum : Designated waste

Manganese : N/A

Iron : Designated waste

Zinc : N/A

E. Other requirements in domestic and other countries

Domestic regulation

Residual Organic Pollutant Control Act : N/A

Foreign regulation

US Administration Information(OSHA Rule : N/A

US Administration Information(CERCLA Rule) : (Zinc)453.599 kg 1000 lb

US Administration Information (EPCRA 302 Rule) : N/A

US Administration Information (EPCRA 304 Rule) : N/A

US Administration Information (EPCRA 313 Rule)

Magnesium : N/A

Aluminum : Applicable

Manganese : Applicable

Iron : N/A

Zinc : Applicable

US Administration Information (Rotterdam Convention material) : N/A

US Administration Information (Stockholm Convention substance) : N/A

US Administration Information (Montreal Protocol substance) : N/A

EU Classification information (Confirmed classification result)

Magnesium : F; R15-17

Aluminum : Pyr. Sol. 1

Water-react. 2

Manganese : N/A

Iron : N/A

Zinc : Pyr. Sol. 1

Water-react. 1

Aquatic Acute 1

Aquatic Chronic 1

EU Classification information (Risk phrases)

Magnesium : R15, R17

Aluminum : H250

H261

Manganese : N/A

Iron : N/A

Zinc : H250

H260

H400

H410

EU Classification information (Safety phrases)

Magnesium : S2, S7/8, S43

Aluminum, Manganese, Iron, Zinc : N/A

## 16. Other information

### A. Source of material

#### Magnesium

ICSC (Appearance)

ICSC (Colour)

ICSC (E. Melting point/Freezing point)

ICSC (F. Initial boiling point and boiling range)

ICSC (J. Lower and upper explosion limit/flammability limit)

SCR (K. Vapour pressure)

SRC (L. Solubility)

ICSC (M. Specific gravity)

SRC (O. N-octanol/water Partition coefficient (Kow))

ICSC (P. Auto-ignition temperature)

ICSC (S. Molecular weight)

HSDB (Skin corrosion or irritation)

HSDB (Serious eye damage or irritation)

HSDB (Specific target organ toxicity(Single exposure))

ECOTOX(Crustacea)

SCR (Persistence)

#### Aluminum

ICSC (Appearance)

ICSC (Colour)

HSDB (B. Odor)

HSDB (E. Melting point/Freezing point)

HSDB (F. Initial boiling point and boiling range)

HSDB (L. Solubility)

HSDB (N. Specific gravity)

ICSC (P. Auto-ignition temperature)

HSDB (S. Molecular weight)

ECHA (Oral)

ECHA (Inhalation)

ECHA (Serious eye damage or irritation)

ECHA (Respiratory sensitization)

ECHA (Skin sensitization)

ECHA, HSDB (Germ cell Mutagenicity)

ECHA, HSDB (Germ cell toxicity)

HSDB (Specific target organ toxicity(Single exposure))

ECHA, ICSC, IPCS, HSDB (Specific target organ toxicity(Repeated exposure))

IUCLID (Crustacea)

ECHA (Algae)

ECHA (E. Other adverse effects)

## Manganese

ECHA (Appearance)

ECHA (Colour)

HSDB (E. Melting point/freezing point)

HSDB (F. Initial boiling point and boiling range)

ECHA (I. Flammability(solid, gas))

ECHA (K. Vapour pressure)

1 (N. Specific gravity)

HSDB (S. Molecular weight)

ECHA (Oral)

ECHA (Inhalation)

ECHA (Skin corrosion or irritation)

ECHA (Serious eye damage or irritation)

ECHA (Skin sensitization)

ECHA (Germ cell mutagenicity)

CICAD, NITE(Germ cell toxicity)

CICAD (Specific target organ toxicity(Single exposure))

NITE,CICAD (Specific target organ toxicity(Repeated exposure))

ECHA (Fish)



ECHA (Crustacea)

ECHA (Algae)

NITE (Bioaccumulation)

ECHA (D. Mobility in soil)

ECHA, NITE (E. Other adverse effects)

## Iron

HSDB (Appearance)

HSDB (Colour)

HSDB (E. Melting point/Freezing point)

HSDB (F. Initial boiling point and boiling range)

HSDB (K. Vapour pressure)

ICSC (L. Solubility)

ICSC (N. Specific gravity)

pubchem (S. Molecular weight)

ECHA (Oral)

ECHA (Dermal)

ECHA (Skin corrosion or irritation)

ECHA (Serious eye damage or irritation)

ECHA (Skin sensitization)

ECHA (Germ cell mutagenicity)

(Reproductive toxicity)

NITE, CICAD (Specific target organ toxicity (Repeated exposure))

ECHA (Fish)

ECHA (Crustacean)

ECHA (D. Mobility in soil)

## Zinc

ICSC(Appearance)

ICSC(Colour)

HSDB(B. odor)

ICSC(E. Melting point/freezing point)

ICSC(F. Initial boiling point and boiling range)  
ICSC(K. Vapour pressure)  
ICSC(L. Solubility)  
ICSC(N. Specific gravity)  
NLM(O. N-octanol/water Partition coefficient)  
ICSC(P. Auto-ignition temperature)  
ICSC(S. Molecular weight)  
ECHA(Oral)  
ECHA(Inhalation)  
IUCLID (Skin corrosion or irritation)  
ECHA(Serious eye damage or irritation)  
OECD(Skin sensitization)  
ECHA(Germ cell mutagenicity)  
ECHA(Reproductive toxicity)  
ECHA(Specific target organ toxicity (Repeated exposure))  
ECHA(Fish)  
ECHA(Crustacea)  
ECHA(Algae)  
IUCLID (Biodegradable)  
ECHA(E. Other adverse effects)

B. Issuing date : 2020.04.03

C. Revision number : 1 time

D. Others

This information is based on the industrial Safety and Health Act and the knowledge and related materials to date. However, the risk of hazardous substances is not written to all the risks of hazardous substances exist there may be unknown hazards of all chemicals in this material may be prescribed. Therefore, our customers and potential customers should review this information and precaution, look precautions carefully and verify suitability about applicable laws and regulations related to the use and disposal of this product.

This information is intended solely for the purpose of describing the health, safety and environmental requirements of the product handler and should not be construed as an endorsement of the characteristics or quality of the product.

Please understand that it is the sole responsibility of the user to evaluate the final suitability of the product, as it is impossible to control the actual application of this product. It is necessary to establish appropriate safety measures in accordance with the application and usage in case of special handling.

This document can be revised based on the new information.