Safety Data Sheet

Regulation : In accordance with Regulation (EU) 2015/830 (REACH), Annex II, and OSHA 29 CFR 1910.1200

Section I – IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

Important Note: As a solid, manufactured article, exposure to hazardous ingredients is not expected with normal use. This battery is an article pursuant to 29 CFR 1910.1200 and, as such, is not subject to the OSHA Hazard Communication Standard requirement. The information contained in this Safety Data Sheet contains valuable information critical to the safe handling and proper use of the product. This SDS should be retained and available for employees and other users of this product.

1.1 Product identifier

Substance name : INR21700-40T

Synonyms :

Lithium-ion Cell, Lithium-ion Pack, Lithium-ion Battery, Li-Ion Cell, Li-Ion Pack, Li-Ion Battery

1.2 Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses : Lithium-ion batteries

Uses advised against : Use for recommended use only

Further Information : Not available

1.3 Details of the supplier of the safety data sheet

Supplier : SAMSUNG SDI Co., Ltd.

Street address/P.O. Box : 150-20, Gongse-ro, Giheung-gu, Yongin-si, Gyeonggi-do, Korea

Country ID/Postcode/Place : KOR/17084

Telephone number : 1-800-424-9300: US and Canada / 1-703-527-3887: International

Responsible Department: Quality team

E-mail address of competent person responsible for the SDS : Not available

National contact : 1-800-424-9300: US and Canada / 1-703-527-3887: International

1.4 Emergency Telephone

: 1-800-424-9300: US and Canada / 1-703-527-3887: International

Opening hours : Not available

Other comments : Not available

1.5 Further Information

Battery-System: Lithium-ion (Li-ion)

Nominal Voltage: 3.6 V

Rated Capacity: 4.0 Ah

Wh rating: 14.4 Wh

Anode (negative electrode): based on intercalation graphite

Cathode (positive electrode): based on lithiated metal oxide (Cobalt, Nickel, Aluminium)

Remark:

The information and recommendations set forth are made in good faith and believed to be accurate as of the date of preparation. SAMSUNG SDI Co., Ltd. makes no warranty, expressed or implied, with respect to this information and disclaims all liabilities from reliance on it.

Section II – HAZARDS IDENTIFICATION

※ The hazards identification of the SDS is based on the leakage of inner substance to outside due to damage of battery, which is different from the actual hazardness. The actual battery is completely sealed and there is no chemical hazard in the product condition.

2.1 Classification of the substance or mixture

2.1.1 Classification according to Regulation (EC) No. 1272/2008 [CLP] and OSHA 29 CFR 1910.1200 :

Acute toxicity (oral) : Category 4
Skin corrosion/irritation : Category 2
Serious eye damage /eye irritation : Category 2
Skin sensitization : Category 1
Carcinogenicity : Category 1A
Germ cell mutagenicity : Category 1B
Specific target organ toxicity (repeated exposure) : Category 2
Hazardous to the aquatic environment (acute hazard) : Category 1
Hazardous to the aquatic environment (chronic) : Category 1

2.1.2 Additional information:

Classification of the substance or mixture.

Preparation Hazards and Classification: The product is a Lithium ion cell or battery and is therefore classified as an article and is not hazardous when used according to the recommendations of the manufacturer. The hazard is associated with the contents of the cell or battery. Under recommended use conditions, the electrode materials and liquid electrolyte are non-reactive provided that the cell or battery integrity remains and the seals remain intact. The potential for exposure should not exist unless the cell or battery leaks, is exposed to high temperatures or is mechanically, electrically or physically abused/damaged. If the cell or battery is compromised and starts to leak, based upon the battery ingredients, the contents are classified as Hazardous.

Hazardous Materials Information Label (HMIS)
Health: Not available
Flammability: Not available
Physical Hazard: Not available

NFPA Hazard Ratings
Health: Not available
Flammability: Not available
Reactivity: Not available
Unique Hazard: Not available

2.2 Label elements

Hazard pictograms :

Signal word : Danger

Hazard statement :

H302 Harmful if swallowed
H315 Causes skin irritation
H317 May cause an allergic skin reaction
H319 Causes serious eye irritation
H340 May cause genetic defects
H350 May cause cancer
H373 May cause damage to organs through prolonged or repeated exposure
H400 Very toxic to aquatic life
H410 Very toxic to aquatic life with long lasting effects

Precautionary statements:

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 thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P272 Contaminated work clothing should not be allowed out of the workplace.
P273 Avoid release to the environment.
P280 Wear protective gloves/protective clothing/eye protection/face protection/hearing protection.

Treatment :

P301+P312 IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell.
P302+P352 IF ON SKIN: Wash with plenty of water.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308+P313 IF exposed or concerned: Get medical advice/attention.
P314 Get medical advice/attention if you feel unwell.
P321 Specific treatment.
P330 Rinse mouth.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P333+P313 If skin irritation or rash occurs: Get medical advice/attention.
P337+P313 If eye irritation persists: Get medical advice/attention.
P362+P364 Take off contaminated clothing and wash it before reuse.
P391 Collect spillage.

Storage :

P405 Store locked up.

Disposal :

P501 Dispose of contents/container in accordance with federal, state and local environmental control regulations.

Supplemental Hazard information (EU) : Not applicable

2.3 Other hazards :

Appearance, Color and Odor: Solid object with no odor.

Primary Routes(s) of Exposure: These chemicals are contained in a sealed enclosure. Risk of exposure occurs only if the cell or pack is mechanically, thermally, electrically or physically abused to the point of compromising the enclosure.
If this occurs, exposure to the electrolyte solution contained within can occur by inhalation, ingestion, eye contact and skin contact.

Potential Health Effect(s):

Acute (short term): see Section 8 for exposure controls.
In the event that this cell or pack has been ruptured, the electrolyte solution contained within the cell would be corrosive and can cause burns to skin and eyes.
Inhalation: Inhalation of materials from a sealed cell is not an expected route of exposure. Vapors or mists from a ruptured cell may cause respiratory irritation.
Ingestion: Swallowing of materials from a sealed cell is not an expected route of exposure. Swallowing the contents of an open cell can cause serious chemical burns to mouth, esophagus, and gastrointestinal tract.
Skin: Contact between the cell and skin will not cause any harm. Skin contact with the contents of an open cell can cause severe irritation or burns to the skin.
Eye: Contact between the cell and the eye will not cause any harm. Eye contact with the contents of an open cell can cause severe irritation or burns to the eye.
CHRONIC (long term): see Section 11 for additional toxicological data.

Interactions with other chemicals: Immersion in high conductivity liquids may cause corrosion and breaching of the cell or battery enclosure. The electrolyte solution inside of the cells may react with alkaline (basic) materials and present a flammability hazard.

Potential Environmental Effects: Not Available.

Information on whether the substance or mixture meets the criteria for PBT or vPvB : See a section 12.5 of the Safety Data Sheet.

Section III – COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Mixture

CAS No.	EC No.	REACH Registration No.	%[weight]	Name	Common Name (Synonyms)	Classification according to Regulation(EC) No 1278/2008(CLP)
12325-84-7	Not available	-	25~35	Lithium Nickel Oxide	Not available	Carc. 1A H350
7782-42-5	231-955-3	-	20~30	Graphite	Not available	Not classified
7439-89-6	231-096-4	-	10~20	Iron	Not available	Muta. 1B H340 STOT SE. 3 H335 STOT RE. 2 H373
7440-50-8	231-159-6	-	5~15	Copper	Not available	(Copper flakes) Acute Tox. 4 H302 Acute Tox. 3 H331 Eye Irrit. 2 H319 Aquatic Acute 1 H400 Aquatic Chronic 1 H410
12190-79-3	235-362-0	-	1~5	Cobalt lithium dioxide	Not available	Flam. Liq. 3, H226 Acute Tox. 4, H332 Carc. 2 H351 Aquatic Chronic 2 H411
554-12-1	209-060-4	-	1~5	Methyl propanoate	Not available	Flam. Liq. 2, H225 Acute Tox. 4 * H332
7429-90-5	231-072-3	-	1~5	Aluminium	Not available	Pyr. Sol. 1, H250 Water-react. 2, H261 STOT SE. 3 H336
21324-40-3	244-334-7	-	1~3	Lithium hexafluorophosphate(1-)	Not available	Acute Tox. 3 H301 Skin Irrit. 1 H314 Eye Irrit. 1 H318 STOT SE. 3 H336 STOT RE. 2 H373
114435-02-8	483-360-5	-	1~3	4-fluoro-1,3-dioxolan-2-one	Not available	Acute Tox. 4 H302 Skin Sens. 1, H317 Aquatic Chronic 3 H412
616-38-6	210-478-4	-	1~3	Dimethyl carbonate	Not available	Flam. Liq. 2, H225
9002-88-4	618-339-3	-	1~3	Polyethylene	Not available	Not classified
1309-37-1	215-168-2	-	0.1~1	Diiron trioxide	Not available	Not classified
1318-23-6	215-284-3	-	0.1~1	Boehmite (Al(OH)O)	Not available	STOT RE. 2 H373 Aquatic Chronic 2 H411
1333-86-4	215-609-9	-	0.1~1	Carbon black	Not available	Carc. 2 H351
7440-02-0	231-111-4	-	0.1~1	Nickel	Not available	Skin Irrit. 2 H315 Skin Sens. 1, H317 Carc. 2 H351 STOT RE. 1 H372 Aquatic Chronic 3 H412
872-50-4	212-828-1	-	0.1~1	1-Methyl-2-pyrrolidinone	Not available	Skin Irrit. 2 H315 Eye Irrit. 2 H319 Repr. 1B H360D STOT SE 3 H335
11089-89-7	Not available	-	0.1~1	Aluminum lithium oxide (LiAlO)	Not available	Not classified
7440-47-3	231-157-5	-	0.1~1	Chromium	Not available	Not classified
554-13-2	209-062-5	-	0.1~1	Lithium carbonate	Not available	Acute Tox. 4 H302 Eye Irrit. 2 H319 Aquatic Chronic 3 H412

100-41-4	202-849-4	-	0.1~1	Ethylbenzene	Not available	Flam. Liq. 2, H225 Acute Tox. 4 H332 Skin Irrit. 2 H315 Carc. 2 H351 STOT RE 2 H373 (hearing organs) Asp. Tox. 1 H304 Aquatic Chronic 3 H412

Further Information

Because of the cell structure the dangerous ingredients will not be available if used properly.
During charge process a lithium graphite intercalation phase is formed.

Section IV – FIRST-AID MEASURES

4.1 Description of first aid measures

Following eye contact :

- Rinse eyes with plenty of water for at least 15 minutes and seek medical attention.

Following skin contact :

- Remove contaminated clothing and wash before reuse.
- Immediately rinse contact area with plenty of clean water.
- Provide first aid to contacted area to prevent infection.
- Get medical attention.

Following inhalation :

- In case of inhalation of organic electrolyte mist, remove from exposure to fresh air.
- If necessary give oxygen. Get medical attention.

Following ingestion :

- In case of ingestion of electrolyte don't induce vomiting.
- If patient is conscious and alert give 2~4 cupfuls of milk or water.
- Never give anything by mouth to an unconscious person.
- Get medical attention immediately.

Further Information :

- The following first aid measures are required only in case of exposure to interior battery components after damage of the external battery casing.
- Undamaged, closed cells do not represent a danger to the health.

4.2 Most important symptoms and effects, both acute and delayed

Acute effects : Not available

Delayed effects : Not available

4.3 Indication of immediate medical attention and special treatment needed

- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

Section V – FIRE-FIGHTING MEASURES

5.1 Extinguishing media

- When the scale of the fire is small, use a HFC (hydrofluorocarbon) clean-agent fire extinguisher or alcohol resistant foam fire extinguishers. (In case of battery overheating, wear protective gear and immerse heated battery in water)
- In case of large fire, use large amount of water to extinguish.

5.2 Special hazards arising from the substance or mixture

- Flammable gas leaks before ignition and then the product ignites.

5.3 Advice for firefighters

- The ignited battery has a high temperature, so there is a risk of additional ignition even if the fire is extinguished at early stage. Sprinkle a large amount of water until the battery temperature drops to normal temperature.
- If the battery is ignited in multi-stacked condition, multi-stack should be disassembled and then extinguished so that heat is not transferred between batteries
- In the event of a battery fire, cool it by spraying water directly on the battery.
- When handling a overheated battery, wear heat-resistant protective equipment.

Section VI – ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

For non-emergency personnel

Protective equipment : Use personal protective equipment, see Section 8

Emergency procedures :

- In case of cell damage, possible release of dangerous substances and a flammable gas mixture.
- Eliminate all ignition sources.
- Please note that materials and conditions to avoid.
- Battery may emit electrolyte if charging or discharging rates exceed manufacturer's recommendations or if pack has been breached.
- Move battery to well ventilated area to prevent gas accumulation.

For emergency responders

- Eliminate all ignition sources.
- Please note that materials and conditions to avoid.
- Move battery to well ventilated area to prevent gas accumulation.

6.2 Environmental precautions :

- Avoid release to the environment.
- Prevent entry into waterways, sewers, basements or confined areas.

6.3 Methods and material for containment and cleaning up

For containment : Not available

For cleaning up :

- Cover with Dry earth, DRY sand or other non-combustible material and put on the plastic sheet to minimize spreading or contact with rain.
- Move battery to well ventilated area to prevent gas accumulation.

- Dispose in accordance with applicable local, state and federal regulations.

Other information: Not available

6.4 Reference to other sections

- See also sections 8 and 13 of the Safety Data Sheet.

Section VII – HANDLING AND STORAGE

7.1 Precautions for safe handling

- In case of cell damage, possible release of dangerous substances and a flammable gas mixture.
- The battery stores electrical energy and is capable of rapid energy discharge.
- Battery cell contents are under pressure.
- Handle battery carefully to avoid puncturing case or electrically shorting terminals.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures and storage conditions : Not available

Packaging materials : Not available

Requirements for storage rooms and vessels :

- Storage at room temperature (approx. 20℃) at approx. 40% of the nominal capacity
- Keep in closed original container.

7.3 Specific end use(s)

Recommendations : Not available

Industrial sector specific solutions : Not available

Section VIII – EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters

Occupational Exposure limits

Name	ACGIH regulation	Biological exposure index	OSHA regulation	NIOSH regulation	EU regulation
Lithium Nickel Oxide	TWA = 0.1 mg/m^3 (inhalable particulate matter)(Nickel soluble inorganic compounds) TWA = 0.2 mg/m^3 (inhalable particulate matter)(Nickel insoluble inorganic compounds)	Not available	TWA = 1 mg/m^3 (Nickel, metal and insoluble compounds, soluble compounds (as Ni))	TWA = 0.015 mg/m^3 (Nickel metal and other compounds (as Ni))	Not applicable
Graphite	TWA = 2 mg/m^3 (all forms except	Not available	TWA = 15 mppcf	TWA = 2.5 mg/m^3 (resp)	Not applicable

	graphite fibers, respirable particulate matter)				
Iron	TWA = 1 mg/m^3 (Iron salts, soluble)	Not available	Not applicable	Not applicable	Not applicable
Copper	TWA = 0.2 mg/m^3 (Copper fume) TWA = 1 mg/m^3 (Copper dust and mist, Copper compounds as Cu)	Not available	TWA = 0.1 mg/m^3 (Copper Fume (as Cu)) ; 1 mg/m^3 (Dusts and mists (as Cu), Cotton dust)	TWA = 1 mg/m^3 (Copper (dusts and mists, as Cu), other copper compounds (as Cu) except Copper fume)	Not applicable
Cobalt lithium dioxide	TWA = 0.02 mg/m^3 (Cobalt, Cobalt inorganic compounds)	Not available	Not applicable	Not applicable	Not applicable
Methyl propanoate	Not applicable	Not available	Not applicable	Not applicable	Not applicable
Aluminium	TWA = 1 mg/m^3 (respirable particulate matter)(Aluminum, Aluminum insoluble compounds)	Not available	TWA = 15 mg/m^3 (Aluminum metal (as Al), Total dust) ; 5 mg/m^3 (Respirable fraction)	TWA = 10 mg/m^3 (total) ; 5 mg/m^3 (resp)	Not applicable
Lithium hexafluorophosphate(1-)	Not applicable	Not available	Not applicable	Not applicable	Not applicable
4-fluoro-1,3-dioxolan-2-one	Not applicable	Not available	Not applicable	Not applicable	Not applicable
Dimethyl carbonate	Not applicable	Not available	Not applicable	Not applicable	Not applicable
Polyethylene	Not applicable	Not available	Not applicable	Not applicable	Not applicable
Diiron trioxide	TWA = 5 mg/m^3 (respirable particulate matter)	Not available	TWA = 10 mg/m^3 (fume)	TWA 5 mg/m^3 (Iron oxide dust and fume (as Fe))	Not applicable
Boehmite (Al(OH)O)	TWA = 1 mg/m^3 (respirable particulate matter)(Aluminum, Aluminum insoluble compounds)	Not available	Not applicable	Not applicable	Not applicable
Carbon black	TWA = 3 mg/m^3 (inhalable particulate matter)	Not available	TWA = 3.5 mg/m^3	TWA = 3.5 mg/m^3	Not applicable
Nickel	TWA = 1.5 mg/m^3 (inhalable particulate matter)(Nickel, elemental)	Not available	TWA = 1 mg/m^3 (Nickel, metal and insoluble compounds, soluble compounds (as Ni))	TWA = 0.015 mg/m^3 (Nickel metal and other compounds (as Ni))	Not applicable
1-Methyl-2-pyrrolidinone	Not applicable	Not available	Not applicable	Not applicable	TWA = 10 ppm (40 mg/m^3), STEL = 20 ppm (80 mg/m^3)
Aluminum lithium oxide (LiAlO)	TWA = 1 mg/m^3 (respirable particulate matter)(Aluminum, Aluminum insoluble compounds)	Not available	Not applicable	Not applicable	Not applicable

Chromium	TWA = 1 mg/m^3 (inhalable particulate matter)(Chromium, metal)	Not available	TWA = 1 mg/m^3 (Chromium metal and insol. salts (as Cr))	TWA = 0.5 mg/m^3 (Chromium metal)	TWA = 2 mg/m^3 (Chromium metal, Chromium(III) inorganic insoluble compounds, Chromium(II) Inorganic compounds)
Lithium carbonate	Not applicable	Not available	Not applicable	Not applicable	Not applicable
Ethylbenzene	TWA = 20 ppm	Not available	TWA = 100 ppm (435 mg/m^3)	TWA = 100 ppm (435 mg/m^3), STEL = 125 ppm (545 mg/m^3)	TWA = 100 ppm (442 mg/m^3)

8.2 Exposure controls

8.2.1 Appropriate engineering controls :

Substance/mixture related measures to prevent exposure during identified uses:

- Avoid charging batteries in areas where hydrogen gas accumulate.
- Use local exhaust ventilation to maintain concentrations of hydrogen below the Lower Explosive collect and transport flammable gases in ventilation systems.
- Insure proper ventilation is present and electrolyte mist and vapours.

Structural measures to prevent exposure:

- Avoid charging batteries in areas where hydrogen gas accumulate.
- Use local exhaust ventilation to maintain concentrations of hydrogen below the Lower Explosive collect and transport flammable gases in ventilation systems.
- Insure proper ventilation is present and electrolyte mist and vapours.

Organisational measures to prevent exposure: Not available

Technical measures to prevent exposure:

- Insure proper ventilation is present and electrolyte mist and vapours.

8.2.2 Individual protection measures, such as personal protective equipment :

Eye and face protection

- Wear ANSI approved safety glasses with side shield during normal use.
- Wear NIOSH approved face shield with safety glasses and H.V protection during intentional disassembly.

Skin protection

Hand protection

- Wear nitrile butyl rubber, neoprene, or PVC glove during battery component disassembly.
- Discard contaminated work clothing after one work day.

Other skin protection

- Wear protective clothing during battery component disassembly.
- Discard contaminated work clothing after one work day.

Respiratory protection :

- None required during normal use.
- Wear NIOSH or European Standard EN 149 approved full or half face piece (with goggles) respiratory protective equipment when necessary.
- In lack of oxygen(< 19.5%), wear the supplied-air respirator or self-contained oxygen breathing apparatus.

- In case exposed to particulate material, the respiratory protective equipment as follow are recommended; facepiece filtering respirator or air-purifying respirator, high-efficiency particulate air(HEPA) filter media or respirator equipped with powered fan, filter media of use (dust, mist, fume)

8.2.3 Environmental exposure controls

Substance/mixture related measures to prevent exposure: Not available
Instruction measures to prevent exposure: Not available
Organisational measures to prevent exposure: Not available
Technical measures to prevent exposure: Not available

Section IX – PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

Appearance
Description : Solid
Color : Not available
Odor : Odorless
Odor threshold : Not available
pH : Not available
Melting point/freezing point : Not available
Initial boiling point and boiling range : Not available
Flash point : Not available
Evaporation rate : Not available
Flammability (solid, gas) : Not available
Upper/lower flammability or explosive limits : Not available
Vapor pressure : Not available
Solubility (ies) : insoluble.
Vapor density : Not available
Relative density : Not available
Partition coefficient: n-octanol/water : Not available
Auto ignition temperature : Not available
Decomposition temperature : Not available
Viscosity : Not available
Explosive properties : Not available
Oxidizing properties : Not available
Molecular weight : Not available

9.2 Other information

Not available

Section X – STABILITY AND REACTIVITY

10.1 Reactivity

- Stable at ambient temperature.

10.2 Chemical stability

- There is no hazard when the measures for handling and storage are followed.
- Stable under normal temperatures and pressures.

10.3 Possibility of hazardous reactions

- Will not occur under normal conditions.
- In case of cell damage, possible release of dangerous substances and a flammable gas mixture.
- Containers may explode when heated.
- Fire may produce irritating and/or toxic gases.
- Inhalation of material may be harmful.

10.4 Conditions to avoid

- Keep away from heat/sparks/open flames/hot surfaces. No smoking.
- Friction, heat, sparks or flames
- Dusts or shavings from borings, turnings, cuttings, etc.
- Do not exceed manufacturer's recommendation for charging or use battery for an application for which it was not specifically designed.
- Do not electrically short.

10.5 Incompatible materials

- Avoid contact with acids and oxidizers.
- Keep away from any possible contact with water, because of violent reaction and possible flash fire.
- Handle under inert gas. Protect from moisture.
- Combustibles, reducing agents

10.6 Hazardous decomposition products

- None under normal conditions.
- Corrosive and/or toxic fume
- Material may produce irritating and highly toxic gases from decomposition by heat and combustion during burning.
- Irritating and/or toxic gases

Section XI – TOXICOLOGICAL INFORMATION

※ This is a product that fulfills a certain function in solid state with specific shape without discharging any chemical substance in its use and has no obligation to write (M)SDS. Since this document contains the precautions for safe handling related to its materials or chemical substances consisting of this product, please note that these overall information is irrelevant to this product.

11.1 Information on toxicological effects

Acute toxicity

Oral : Category 4 **(**ATEmix = 1,716 mg/kg bw)

- Graphite : Rat LD_{50} > 2,000 mg/kg (female)(OECD Guideline 401)
- Fe : Rat LD_{50} = 98,600 mg/kg (Reduced iron, OECD Guideline 401)
- Copper : Rat LD_{50} > 2,500 mg/kg (Read across : Cupric oxide)(OECD Guideline 423, GLP)
- Aluminum : Rat LD_{50} > 15,900 mg/kg (OECD Guideline 401)(Read across : Fumed alumina)

- Lithium hexafluorophosphate(1-) : Rat LD_{50} = 50 ~ 300 mg/kg (female)(OECD Guideline 423, GLP)
- 4-fluoro-1,3-dioxolan-2-one : Rat LD_{50} = 500 mg/kg (male)(OECD Guideline 423)
- Dimethyl carbonate : Rat LD_{50} > 5,000 mg/kg (male/female) (OECD Guideline 401)
- Polyethylene : Rat LD_{50} > 2,000 mg/kg
- Diiron trioxide : Rat LD_{50} > 5,000 mg/kg (male/female)(EU Method B.1)
- Boehmite (Al(OH)O) : Rat LD_{50} > 2,000 mg/kg (OECD Guideline 423, GLP)
- Carbon black : Rat LD_{50} > 8,000 mg/kg (OECD Guideline 401)
- Nickel; Raney nickel : Rat LD_{50} > 9,000 mg/kg (male/female) (OECD Guideline 401, GLP)
- 1-Methyl-2-pyrrolidinone : Rat LD_{50} = 4,150 mg/kg (male/female)(OECD Guideline 401)
- Chromium : Rat LD_{50} > 5,000 mg/kg (Read across : chromium(III) oxide)(OECD Guideline 420, GLP)
- Lithium carbonate;Lithane : Rat LD_{50} = 525 mg/kg
- Ethylbenzene : Rat LD_{50} = 3,500 mg/kg (male or female)

Dermal : Not classified **(**ATEmix = 1,026,228 mg/kg bw)

- Copper : Rat LD_{50} > 2,000 mg/kg (OECD Guideline 402, GLP)
- 4-fluoro-1,3-dioxolan-2-one : Rat LD_{50} > 2,000 mg/kg (male/female) (OECD Guideline 402)
- Dimethyl carbonate : Rabbit LD_{50} > 2,000 mg/kg (male/female)
- 1-Methyl-2-pyrrolidinone : Rat LD_{50} > 5,000 mg/kg (male/female) (OECD Guideline 402)
- Lithium carbonate;Lithane : Rabbit LD_{50} > 3,000 mg/kg (male/female) (OECD Guideline 402)
- Ethylbenzene : Rabbit LD_{50} = 15,432 mg/kg

Inhalation : Not classified **(**ATEmix = 143.7 mg/L)

- Graphite : Rat LD_{50} > 2 mg/L/4hr (male/female) (OECD Guideline 403)
- Fe : Rat LC_{50} > 100 mg/m³/6hr
- Aluminum : Rat LC_{50} > 0.888 mg/L/4hr (analytical) (OECD Guideline 403)
- Dimethyl carbonate : Rat LD_{50} > 5.36 mg/L/4hr (male/female) (OECD Guideline 403)
- Diiron trioxide : Rat LC_{50} = 5.05 mg/L/4hr (male/female) (OECD Guideline 403, GLP)
- Boehmite (Al(OH)O) : Rat LD_{50} > ~ 0.888 mg/kg/4hr (OECD Guideline 403, GLP)
- Carbon black : Rat LC_{50} > 0.005 mg/L/4hr
- 1-Methyl-2-pyrrolidinone : Rat LC_{50} > 5.1 mg/L/4hr (male/female) (OECD Guideline 403)
- Chromium : Rat LD_{50} > 5.41 mg/L/4hr (Read across : chromium(III) oxide)(OECD Guideline 403, GLP)
- Lithium carbonate;Lithane : Rat LC_{50} > 2 mg/L/4hr (male/female) (OECD Guideline 403)
- Ethylbenzene : Rat LC_{50} = 17.8 mg/L/4hr

Skin corrosion/ irritation : Category 2

- Graphite : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404, GLP)
- Fe : In test on skin irritation with rabbits, skin irritations were not observed.(Read across : Fe_3O_4)(OECD Guideline 404, GLP)
- Copper : In test on skin irritation with rabbits, skin irritations were not observed. (OECD Guideline 404, GLP)
- Aluminum : Aluminium oxide caused slight erythema in 2/12 rabbits. The observed effects do not lead to a classification. Aluminium oxide is, therefore, not considered to be a primary skin irritant.(OECD Guideline 404)(Read across : aluminium oxide)

- Lithium hexafluorophosphate(1-) : In the skin irritation test using human, the test material was corrosive. (EU Method B.40, GLP)
- 4-fluoro-1,3-dioxolan-2-one : In the skin irritation test using human skin model, the test material was non-corrosive. (OECD Guideline 431, GLP)
- Dimethyl carbonate : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404)
- Polyethylene : No irritation was observed at the other two treated sites and no corrosive effects were noted during the study using rabbits. The primary irritation index was calculated as 0.2 and polyethylene was classified as a mild irritant.
- Diiron trioxide : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404, GLP)
- Boehmite (Al(OH)O) : In the skin irritation test using rabbits, skin irritations were not observed.(OECD Guideline 404, GLP)
- Carbon black : In test on skin irritation with rabbits, skin irritations were not observed. (OECD Guideline 404)
- Nickel; Raney nickel : Industrial nickel dust causes nickel dermatitis.
- 1-Methyl-2-pyrrolidinone : In the skin irritation test using rabbits, the test material was slightly irritating. (OECD Guideline 404, GLP)
- Chromium : In test on skin irritation with rabbits, skin irritations were not observed.(Read across : chromium(III) oxide)(OECD Guideline 404, GLP)
- Lithium carbonate;Lithane : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404, GLP)
- Ethylbenzene : In test on skin irritation with rabbits, moderate irritations were observed to rabbit skin.

Serious eye damage/ irritation : Category 2

- Graphite : In the eye irritation test using rabbit, the test material was not irritating. (OECD Guideline 405, GLP)
- Fe : In test on eyes irritation with rabbits, eyes irritations were not observed.(Read across : Fe3O4)(OECD Guideline 405, GLP)
- Copper : In test on eyes irritation with rabbits, skin irritations were not observed. (OECD Guideline 405, GLP)
- Aluminum : An eye irritation study of the aluminium oxide was performed in rabbits. No eye irritation/ corrosion effects were observed. (Read across : aluminium oxide)
- Lithium hexafluorophosphate(1-) : In the eye irritation test using fertilised brown leghorn chicken eggs, the test material was severely irritating. (GLP)
- Dimethyl carbonate : In the eye irritation test using rabbit, the test material was not irritating. (GLP)
- Polyethylene : Mild irritants were observed in eye irritation test with rabbits. (Score 11.7/110)
- Diiron trioxide : In the eye irritation test using rabbits, the test material was not irritating. (OECD Guideline 405, GLP)
- Boehmite (Al(OH)O) : In the eyes irritation test using rabbits, the test material was not irritating.(OECD Guideline 405, GLP)
- Carbon black : In test on eyes irritation with rabbits, eyes irritations were snot observed. (OECD Guideline 405)
- 1-Methyl-2-pyrrolidinone : In the eye irritation test using rabbit, the test material was moderately irritating. (OECD Guideline 405, GLP)
- Chromium : In test on eyes irritation with rabbits, eyes irritations were not observed. (Read across : chromium(III) oxide)(OECD Guideline 405, GLP)

- Lithium carbonate;Lithane : In the eye irritation test using rabbit, the test material was moderately irritating. (OECD Guideline 405, GLP)
- Ethylbenzene : In test on eyes irritation with rabbits, slight irritations were observed to rabbit.

Respiratory sensitization : Not classified

- Aluminum : Al_2O_3 was the least inflammatory material tested and led to only weak effects on the mouse lung. (Read across : Aluminium oxide)
- Boehmite (Al(OH)O) : In respiratory sensitization test with mice, it did not induce respiratory sensitization.
- Carbon black : In respiratory sensitization test with mice, it did not induce respiratory sensitization.

Skin sensitization : Category 1

- Graphite : In the skin sensitization test using mice, the test material was not skin sensitization. (OECD Guideline 429, GLP)
- Fe : In the test using guinea pigs, the test substance was not considered to be a dermal sensitizer in guinea pigs.(Read across : FeO, Fe_2O_3)
- Copper : In maximization test on skin sensitization with guinea pig, skin sensitization was not observed. (OECD Guideline 406, GLP)
- Aluminum : In test with guinea pigs, it can be concluded that aluminium oxide has no sensitisation potential under the experimental conditions. (Read across : Aluminium oxide)
- Lithium hexafluorophosphate(1-) : In the skin sensitization test using mice, the test material was not skin sensitization. (OECD Guideline 429, GLP)
- 4-fluoro-1,3-dioxolan-2-one : In the skin sensitization test using mice, the test material was skin sensitization. (OECD Guideline 429, GLP)
- Dimethyl carbonate : In the skin sensitization test using guinea pig, this material was not skin sensitizing. (OECD Guideline 406, GLP)
- Polyethylene : No reactions were observed in skin sensitization test with guinea pigs.
- Diiron trioxide : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing.
- Boehmite (Al(OH)O) : In the skin sensitization test using guinea pig, this material was not skin sensitizing.(OECD Guideline 406, GLP)
- Carbon black : In skin sensitization test with guinea pig, it did not induce skin sensitization. (OECD Guideline 406, GLP)
- Nickel; Raney nickel : Nickel hypersensitivity dermatitis may be initiated by contact with nickel on the skin.
- 1-Methyl-2-pyrrolidinone : In the skin sensitization test using mice, the test material was not skin sensitization. (OECD Guideline 429, GLP)
- Chromium : In vitro skin sensitisation test, the test substance was not considered to be a dermal sensitizer.
- Lithium carbonate;Lithane : In the skin sensitization test using guinea pig, this material was not skin sensitizing. (OECD Guideline 406, GLP)

Carcinogenicity : Category 1A

IARC

- Lithium Nickel Oxide : Group 1 (Nickel compounds)
- Cobalt lithium dioxide : Group 2B (Cobalt and cobalt compounds)
- Polyethylene : Group 3
- Diiron trioxide : Group 3 (Ferric oxide)
- Carbon black : Group 2B

- Nickel : Group 2B (Nickel, metallic and alloys)
- Chromium : Group 3 (Chromium, metallic)
- Ethylbenzene : Group 2B

ACGIH

- Lithium Nickel Oxide : A1 (Nickel insoluble inorganic compounds), A4 (Nickel soluble inorganic compounds)
- Cobalt lithium dioxide : A3 (Cobalt, Cobalt inorganic compounds)
- Aluminium : A4 (Aluminum, Aluminum insoluble compounds)
- Diiron trioxide : A4
- Boehmite (Al(OH)O) : A4 (Aluminum, Aluminum insoluble compounds)
- Carbon black : A3
- Nickel : A5 (Nickel, elemental)
- Aluminum lithium oxide (LiAlO) : A4 (Aluminum, Aluminum insoluble compounds)
- Ethylbenzene : A3

NTP

- Lithium Nickel Oxide : K (Nickel compounds)
- Cobalt lithium dioxide : R (Cobalt, Cobalt compounds)
- Nickel : R (Metallic Nickel)

OSHA

- Lithium Nickel Oxide : Present (Nickel, metallic, Nickel compounds)
- Cobalt lithium dioxide : Present (Cobalt and cobalt compounds)
- Carbon black : Present
- Nickel : Present (Nickel, metallic, Nickel compounds)
- Ethylbenzene : Present

EU

- Nickel : Carc. 2

- Copper : EPA IRIS: D In carcinogenicity study with rat, tumor was not observed.
- Polyethylene : Fifty rats were implanted with polyethylene. In the polyethylene group, 23 developed tumors (two of these were unrelated to the implants).
- Boehmite (Al(OH)O) : bauxite and alumina exposure was not associated with increased cancer risk.
- Ethylbenzene : there was clear evidence of carcinogenic activity of Ethylbenzene in rat(male/female)with based on increased incidences of renal tubule neoplasms; increased incidence of testicular adenoma.

Mutagenicity : Category 1B

- Graphite : Negative reactions were observed in vitro (Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP)).
- Fe : In mammalian cell gene mutation assay electrolytic iron, positive carbonyl iron exhibited a cytotoxic and mutagenic response (OECD Guideline 476)
- Copper : Negative reactions were observed in both in vitro(Ames test) and in vivo(DNA damage and/or repair; unscheduled DNA synthesis, micronucleus assay). (GLP)
- Aluminum : Negative reactions were observed in vitro (mammalian cell gene mutation assay with mouse lymphoma L5178Y cells(OECD Guideline 476, GLP)) and in vivo (micronucleus assay with rats (OECD Guideline 474, GLP)). (Read across : Aluminium hydroxide, aluminium chloride, aluminum oxide)
- Lithium hexafluorophosphate(1-) : Negative reactions were observed in both in vivo (Mammalian Erythrocyte Micronucleus test(OECD Guideline 474)) and in vitro (Bacterial Reverse Mutation

Assay(OECD Guideline 471, GLP)).
- 4-fluoro-1,3-dioxolan-2-one : Positive reactions were observed in vitro (Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP)) and Negative reactions were observed in vivo (Mammalian Erythrocyte Micronucleus Test(OECD Guideline 474, GLP)).
- Dimethyl carbonate : Negative reactions were observed in both in vitro (Mammalian Chromosome Aberration Test (OECD Guideline 473, GLP)) and in vivo (Mammalian Spermatogonial Chromosome Aberration Test (OECD Guideline 483))
- Polyethylene : Negative reactions were observed in Ames test using Salmonella typhimurium and Escherichia coli.
- Diiron trioxide : Negative reactions were observed in both in vitro (Mammalian Chromosome Aberration Test (OECD Guideline 473, GLP)) and in vivo (DNA damage, chromosome aberration and micronuclei induction test)
- Boehmite (Al(OH)O) : Negative reactions were observed in vitro(mammalian cell gene mutation assay(OECD Guideline 476, GLP), Negative reactions were observed in vivo Mammalian Erythrocyte Micronucleus Test(OECD Guideline 474, GLP)
- Carbon black : Negative reactions were observed in both in vitro(Bacterial gene mutation test(OECD Guideline 471, GLP), Chromosomal aberrations test(OECD Guideline 476)) and in vivo(DNA damage and/or repair test).
- 1-Methyl-2-pyrrolidinone : Negative reactions were observed in both in vitro (Chromosomal aberrations test (OECD Guideline 476, GLP)) and in vivo (Mammalian Erythrocyte Micronucleus Test (OECD Guideline 474, GLP)).
- Chromium : In vitro mammalian chromosome aberration test, the result of the assay was negative. (Read across : stainless steel)(OECD Guideline 473, GLP)
- Lithium carbonate;Lithane : Negative reactions were observed in vitro (Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP)).
- Ethylbenzene : Negative reactions were observed in in vitro-mammalian chromosome aberration test(OECD Guideline 473), mammalian cell gene mutation test (OECD Guideline 476, GLP) and in vivo-unscheduled DNA synthesis (UDS) test with mammalian liver cells (OECD Guideline 486, GLP), mammalian erythrocyte micronucleus test (OECD Guideline 474, GLP).

Reproductive toxicity : Not classified
- Graphite :
- Copper : In reproductive toxicity with rats, there were no effects considered (up to 1500 ppm). (OECD Guideline 416, GLP)
- Aluminum : No reproduction, breeding and early post-natal developmental toxicity was observed in rats at 1000 mg/kg bw for males and females. (OECD Guideline 422, GLP)(Read across : Aluminium chloride)
- Lithium hexafluorophosphate(1-) : In the two-generation reproductive toxicity with rats, no effects observed on reproductive toxicity. (male/female)(OECD Guideline 416, GLP)(OECD Guideline 414)(Information on major hydrolysis product of the registered substance (released rapidly on contact with water/moisture))
- Boehmite (Al(OH)O) : No reproduction, breeding and early post-natal developmental toxicity was observed in rats at 1000 mg/kg body weight for males and females.(OECD Guideline 422, GLP)
- Carbon black : No adverse effects on the reproductive function are expected.(OECD Guideline 414)
- Chromium : In the 90 days inhalation toxicity study using rat, there were no effects on clinical signs, mortality.(OECD Guideline 413)
- Ethylbenzene : There were no adverse effects on reproductive or developmental endpoints at dose

levels up to 500 ppm EB in this guideline two-generation rat inhalation study. OECD Guideline 416, GLP); Results of prenatal Developmental Toxicity tests for rats, litter size was comparable between the treated and control dose groups, while a statistically significant dose-related reduction in fetal weights were noted in the 1000 and 2000 ppm dose groups. Visceral malformations occurred in one or few fetuses from the 100, 1000 and 2000 ppm exposure groups, without a clear dose relationship and no statistical significance. NOAEC = 2000ppm (OECD Guideline 414)

Specific target organ toxicity (single exposure) : Not classified

- Fe : If inhaled, iron is a local irritant to the lung and gastrointestinal tract.
- Copper : All animals showed expected gains in bodyweight over the study period and there were no abnormalities noted at necropsy. (OECD Guideline 423, GLP)
- Aluminum : In test using rats, Clinical signs of depression, laboured respiration, piloerection and hunched appearance was noted at the highest dose 15900 mg/kg. Macroscopic examination at the end of the observation period did not reveal any aluminium-related changes of the internal organs of the aluminium treated animals compared to the control group. (OECD Guideline 401)(Read across : Fumed alumina)
- Lithium hexafluorophosphate(1-) : Clinical signs observed during the study period were lethargy, hunched posture, uncoordinated movements, piloerection at 300 mg/kg, hunched posture, piloerection at 50 mg/kg. The surviving animals had recovered from the symptoms by Day 3. (OECD Guideline 423, GLP)
- Polyethylene : No test substance-related toxic effects were observed in an acute oral toxicity study with rats.
- Carbon black : No effect on endothelins or blood pressure was observed after exposure to carbon black. There were also no effects on body temperature and activity of the animals.
- Nickel; Raney nickel : In the acute oral toxicity using rat, there were no effects on clinical signs, systemic toxicity.(OECD Guideline 401, GLP)
- Chromium : In the acute oral toxicity using rat, salivation increased among all animals 15 minutes after administration of the test substance, and lasted about 8 hours. (OECD Guideline 420, GLP)
- Ethylbenzene : In acute oral, inhalation, dermal toxicity study with rats, adverse effects were not observed related to acute toxicity.

Specific target organ toxicity (repeat exposure) : Category 2

- Fe : Rats were exposed to metallic iron as carbonyl iron via their feed (2.5%) for 2, 4, 6, or 9 weeks. This resulted in a strong increase of non-heme iron in the liver and clear lipid peroxidation in the liver and the mucosa of the duodenum. No evidence for DNA breakage were found. What follows is the original abstract of the publication. (carbonyl iron)
- Copper : In test with rats for 92 days, there were no mortalities or signs of clinical toxicity observed in any of the test species during the duration of the study. Opthalmoscopic examinations revealed no abnormalities at any dose level tested. At gross pathology, significant decreases in heart and kidney weight were noted in the high dose males in the thymus and kidneys of high dose females. (GLP)
- Aluminum : On occasion workers chronically exposed to aluminum-containing dusts or fumes have developed severe pulmonary reactions including fibrosis, emphysema and pneumothorax.
- Lithium hexafluorophosphate(1-) : According to expert review of fluoride intake and effects on human health, fluoride intake in drinking water at levels close to or above 4 mg/l is associated with dental fluorosis and perhaps also bone fluorosis and/or weakening.; Damage to dental enamel recorded: especially notable in young animals, which also showed atrophy of respiratory organs/tissues with local oedema of bronchial mucosa. Older animals showed peribronchial hyperplasia. Animals around 1 year in age showed cavity formation in their bones.(Information on major hydrolysis product of the

registered substance (released rapidly on contact with water/moisture))(OECD Guideline 412)
- Polyethylene : No significant adverse effects were observed in subchronic (90-day) oral toxicity study with rats and dogs.
- Boehmite (Al(OH)O) : There were no clear clinical signs or observations during necropsy which could be related to the treatment.(OECD Guideline 408, GLP), Intratracheal injection of aluminium powder caused nodular pulmonary fibrosis in the lungs of the rats only at the highest dose administered (100 mg).(OECD Guideline 413)
- Carbon black : Mice were continuously fed various types of carbon black in massive quantities (10% in diet) for 12 to 18 months. This led to no detectable changes from the normal in the organs and tissues of the mice fed.
- Nickel; Raney nickel : In nickel plating industry, exposure to nickel containing vapors has been reported to be assoc with asthma.
- Chromium : In the repeated Dose 90-Day Oral toxicity test using rat, there were no effects on clinical signs, mortality.
- Ethylbenzene : In repeated oral toxicity study with rats for 28 days, increased liver weight and hepatocellular hypertrophy at higher dose levels were observed. (NOEAL = 75 mg/kg bw/day) (OECD Guideline 407, GLP); In repeated inhalation toxicity study with rats for 13 weeks, increases in liver and kidney weights but no other treatment related effects were observed in rats that inhaled ≥250 ppm Ethylbenzene vapour for 13 weeks, NOAEC = 1000ppm (OECD Guideline 413, GLP), Classified as Category 2 according to EU GHS

Aspiration Hazard : Not classified
- Ethylbenzene : Classified as Category 1 according to EU GHS

Section XII – ECOLOGICAL INFORMATION

※ This is a product that fulfills a certain function in solid state with specific shape without discharging any chemical substance in its use and has no obligation to write (M)SDS. Since this document contains the precautions for safe handling related to its materials or chemical substances consisting of this product, please note that these overall information is irrelevant to this product.

12.1 Ecological toxicity
- Acute toxicity : Category 1 (ATEmix = 0.18 mg/L)
- Chronic toxicity : Category 1

Fish
- Graphite : 96hr-LC_{50} (*Brachydanio rerio*) > 100 mg/L
- Fe : 96hr-LC_{50} > 10000 mg/L (OECD Guideline 203, GLP)
- Cobalt lithium dioxide: 96hr-LC_{50} = 54.1 mg/L (Read across : cobalt (II) chloride hexahydrate), 34d-NOEC (*Pimephales promelas*) = 0.21 mg/L
- Aluminum : 96hr-LC_{50} > 218.64 mg/L (GLP)(Read across : aluminium chloride hexahydrate), 28d-NOEC (*Pimephales promelas*) = 4.7 mg/L (Read across : aluminium sulphate)
- Lithium hexafluorophosphate(1-) : 96hr-LC_{50} = 51 ~ 193 mg/L Information on major hydrolysis product of the registered substance (released rapidly on contact with water/moisture); 21d-NOEC = 4 mg F-/L
- Boehmite (Al(OH)O) : 96hr-LC_{50} = 1.16 mg/L
- Carbon black : 96hr-LC_0 = 1000 mg/L (OECD Guideline 203, GLP)

- 1-Methyl-2-pyrrolidinone : 96hr-LC_{50} > 500 mg/L (BBA-bulletin No. 33, 2. edition)
- Lithium carbonate;Lithane : 96hr-LC_{50} = 30.3 mg/L (OECD Guideline 203, GLP), 34d-NOEC (*Danio rerio*) = 15.28 mg/L (Read across : lithium hydroxide monohydrate)(OECD Guideline 210, GLP)
- Ethylbenzene : 96hr-LC_{50} = 4.2 mg/L (OECD Guideline 203)

Crustacean

- Graphite : 48hr-EC_{50} (*Daphnia magna*) > 100 mg/L
- Fe : 48hr-EC_{50} > 100 mg/L (OECD Guideline 202, GLP)
- Cobalt lithium dioxide: 48hr-EC_{50} = 2.618 mg/L (GLP)(Read across : cobalt (II) chloride hexahydrate), 42d-NOEC (*Neanthes arenaceodentata*) = 0.713 mg/L (ASTM Method E1562, GLP)
- Aluminum : 48hr-LC_{50} = 0.071 mg/L (Read across : CAS 13473-90-0), 8d-NOEC (*Ceriodaphnia dubia*) = 4.9 mg/L (Read across : CAS 7784-13-6)
- Lithium hexafluorophosphate(1-) : 48hr-LC_{50} > 100 mg/L (OECD Guideline 202, GLP);21d-NOEC(*Daphnia magna*) = 10 mg/L (Information on major hydrolysis product of the registered substance (released rapidly on contact with water/moisture)) (OECD guideline 202, GLP)
- 4-fluoro-1,3-dioxolan-2-one : 48hr-LC_{50} = 8.4 mg/L (OECD Guideline 202, GLP)
- Boehmite (Al(OH)O) : 48hr-EC_{50} > 100 mg/L (OECD Guideline 202, GLP)
- Carbon black : 24hr-EC_{50} > 5600 mg/L (OECD Guideline 202, GLP)
- 1-Methyl-2-pyrrolidinone : 24hr-EC_{50} > 1000 mg/L German Industrial Standard DIN 38 412 Part 11
- Lithium carbonate;Lithane : 48hr-EC_{50} = 33.2 mg/L (OECD Guideline 202, GLP), 21d-NOEC (*Daphnia magna*) = 9 mg/L (Read across : lithium)(OECD Guideline 211, GLP)
- Ethylbenzene : 48hr-EC_{50} = 1.8 ~ 2.4 mg/L (EPA method F), 7d-NOEC(*Ceriodaphnia dubia*) = 0.96 mg/L (U.S. EPA 600/4-91-003)

Algae

- Graphite : 72hr-EC_{50} (*Selenastrum capricornutum*) > 100 mg/L
- Cobalt lithium dioxide: 96hr-EC_{50} = 71.314 mg/L (Read across : cobalt (II) chloride hexahydrate), 96hr-NOEC (*Dunaliella tertiolecta*) = 4.672 mg/L
- Methyl propanoate : 96hr-EC_{50} > 500 mg/L
- Aluminum : 72hr-EC_{50} = 0.0169 mg/L (OECD Guideline 201), (Read across : CAS 13473-90-0)
- Lithium hexafluorophosphate(1-) : 96hr-EC_{50} > 100 mg/L ; 96h-NOEC = 22 mg/L (OECD Guideline 201, GLP)
- 4-fluoro-1,3-dioxolan-2-one : 72hr-EC_{50} = 32 mg/L
- Boehmite (Al(OH)O) : 72hr-EC_{50} > 100 mg/L (OECD Guideline 201, GLP)
- Carbon black : 72hr-EC_{50} > 10000 mg/L , 72hr-NOEC > 10,000mg/l (OECD Guideline 201, GLP)
- 1-Methyl-2-pyrrolidinone : 72hr-EC_{50} = 600.5 mg/L
- Lithium carbonate;Lithane : 72hr-EC_{50} > 400 mg/L
- Ethylbenzene : 96hr-EC_{50} = 3.6 mg/L (U.S. EPA. 1985. Toxic substance Control Act Test guidelines)

12.2 Persistence and degradability

Persistence

- Graphite : Low persistency (log K_{ow} is less than 4 estimated.) (Log K_{ow} = 0.78)
- Aluminum : Low persistency (log K_{ow} is less than 4 estimated.) (Log K_{ow} = 0.33) (estimated)
- Lithium hexafluorophosphate(1-) : Low persistency (log K_{ow} is less than 4 estimated.) (Log K_{ow} = 0.354) (20 °C, pH > 6.5 - < 7.5)(OECD Guideline 107, GLP)
- 4-fluoro-1,3-dioxolan-2-one : Low persistency (log K_{ow} is less than 4 estimated.) (Log K_{ow} = -0.435)

- 1-Methyl-2-pyrrolidinone : Low persistency (log K_{ow} is less than 4 estimated.) (Log K_{ow} = -0.46)
- Ethylbenzene : Low persistency (log K_{ow} is less than 4 estimated.) (Log K_{ow} = 3.6) (EU Method A.8)

Degradability : Not available

12.3 Bioaccumulative potential

Bioaccumulation

- Graphite : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 2.433)
- Copper : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 0.02 ~ 20)
- Cobalt lithium dioxide: Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 23) (Read across : 57CoCl)
- Aluminum : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 3.162) (estimated)
- Lithium hexafluorophosphate(1-) : Bioaccumulation is expected to be low according to the BCF < 500 (BCF < 31)
- 4-fluoro-1,3-dioxolan-2-one : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 3.162) (estimated)
- Dimethyl carbonate : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 3.2)
- Nickel; Raney nickel : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 70)
- Ethylbenzene : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 1)

Biodegradation

- Lithium hexafluorophosphate(1-) : As well-biodegraded, it is expected to have low accumulation potential in living organisms (= 86% biodegradation was observed after 28 days) (OECD Guideline 301 C, GLP)
- 4-fluoro-1,3-dioxolan-2-one : As not well-biodegraded, it is expected to have high accumulation potential in living organisms (= 38% biodegradation was observed after 21 days) (OECD Guideline 301 D, GLP)
- Dimethyl carbonate : As well-biodegraded, it is expected to have low accumulation potential in living organisms (= 86% biodegradation was observed after 28 days) (OECD Guideline 301 C, GLP)
- Polyethylene : As not well-biodegraded, it is expected to have high accumulation potential in living organisms (= 0% biodegradation was observed after 28 days)
- Carbon black : carbon black is an inorganic substance and will not biodegraded by microorganisms.
- 1-Methyl-2-pyrrolidinone : As well-biodegraded, it is expected to have low accumulation potential in living organisms (= 73% biodegradation was observed after 28 days)
- Ethylbenzene : As well-biodegraded, it is expected to have low accumulation potential in living organisms (70% ~ 80% biodegradation was observed after 28 days) (ISO 14593-CO2-Headspace Test)

12.4 Mobility in soil

- 4-fluoro-1,3-dioxolan-2-one : Low potency of mobility to soil. (K_{oc} = 5.117)
- Nickel; Raney nickel : Low potency of mobility to soil. (K_{oc} = 2.86)
- 1-Methyl-2-pyrrolidinone : Low potency of mobility to soil. (K_{oc} = 20.94) (estimated)
- Ethylbenzene : Low potency of mobility to soil. (K_{oc} = 257.04)

12.5 Results of PBT and vPvB assessment : Not available

12.6 Other adverse effects : Not available

Section XIII – DISPOSAL CONSIDERATION

13.1 Waste treatment methods

Product/Packaging disposal

- Consider the required attentions in accordance with waste treatment management regulation.

Waste codes / Waste designation according to LoW(2015) : 16-06-05

Waste treatment-relevant information

- Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Sewage disposal-relevant information: Not available

Other disposal recommendations: Not available

Section XIV – TRANSPORTATION INFORMATION

※ If those lithium-ion batteries are packed with or contained in an equipment, then it is the responsibility of the shipper to ensure that the consignment are packed in compliance to the latest edition of the IATA Dangerous Goods Regulations section II of either Packing Instruction 966 or 967 in order for that consignment to be declared as NOT RESTRICTED (non-hazardous/non-Dangerous). If those lithium-ion batteries are packed with or contained in an equipment, UN No. is UN3481.

14.1 UN Number : 3480

14.2 UN Proper shipping name : LITHIUM ION BATTERIES (including lithium ion polymer batteries)

14.3 Transport Hazard class : 9

14.4 Packing group : II

14.5 Special provisions : 188, 230, 384

14.6 Packing instructions : P903

14.7 Environmental hazards : No

14.8 Special precautions for user

in case of fire : F-A

in case of leakage : S-I

14.9 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not Available

14.10 IATA Transport : PI 965-Section IB

14.11 Package labels

Section XV – REGULATORY INFORMATION

15.1 Safety, health and environmental regulation/legislation specific for the substance or mixture

EU regulations

Harmonized classification – Annex VI of Regulation (EC) No 1272/2008 (CLP Regulation):

- Copper : (Copper flakes) Acute Tox. 4 H302, Eye Irrit. 2 H319, Acute Tox. 3 H331, Aquatic Acute 1 H400, Aquatic Chronic 1 H410
- Methyl propanoate : Flam. Liq. 2, H225, Acute Tox. 4, H332
- Aluminium : Pyr. Sol. 1, H250, Water-react. 2, H261
- Dimethyl carbonate : Flam. Liq. 2, H225
- Nickel : Skin Sens. 1, H317, Carc. 2, H351, STOT RE 1, H372, Aquatic Chronic 3, H412
- 1-Methyl-2-pyrrolidinone : Skin Irrit. 2, H315, Eye Irrit. 2, H319, STOT SE 3, H335, Repr. 1B, H360D
- Ethylbenzene : Flam. Liq. 2, H225, Acute Tox. 4, H332, Asp. Tox. 1, H304, STOT RE 2, H373(hearing organs)

Authorisations and/or restrictions on use:

Authorisations: Not regulated

Restrictions on use:

- Lithium Nickel Oxide : Regulated (Nickel and its compunds)
- Nickel : Regulated (Nickel and its compunds)
- 1-Methyl-2-pyrrolidinone : Regulated

Other EU regulations:

EU SVHC list

- 1-Methyl-2-pyrrolidinone : Regulated

Foreign Regulatory Information

External information :

U.S.A management information (OSHA Regulation) : Not regulated

U.S.A management information (CERCLA Regulation) :

- Lithium Nickel Oxide : 100 lb (Nickel, Nickel compounds)
- Copper : 5,000 lb
- Nickel : 100 lb (Nickel, Nickel compounds)
- Chromium : 5,000 lb
- Ethylbenzene : 1,000 lb

U.S.A management information (EPCRA 302 Regulation) : Not regulated

U.S.A management information (EPCRA 304 Regulation) : Not regulated

U.S.A management information (EPCRA 313 Regulation) :

- Lithium Nickel Oxide : Regulated (Nickel, Nickel compounds)
- Copper : Regulated (Copper, Copper Compounds)
- Cobalt lithium dioxide : Regulated (Cobalt, Cobalt Compounds)
- Aluminium : Regulated (Aluminum, fume or dust)
- Nickel : Regulated (Nickel, Nickel compounds)
- 1-Methyl-2-pyrrolidinone : Regulated
- Chromium : Regulated (Chromium, Chromium Compounds)
- Lithium carbonate : Regulated
- Ethylbenzene : Regulated

Substance of Rotterdam Convention: Not regulated
Substance of Stockholm Convention: Not regulated
Substance of Montreal Protocol : Not regulated

15.2 Chemical safety assessment :

- No chemical safety assessment has been carried out for this product by the supplier.

Section XVI – OTHER INFORMATION EU

Product safety data sheet 32E1 prepared in accordance with Regulation (EU) 2015/830 (REACH), Annex II, and OSHA 29 CFR 1910.1200

16.1 Indication of changes

Date Updated : May 20, 2019
Version : Rev. 02

16.2 Abbreviations and acronyms

ACGIH = American Conference of Government Industrial Hygienists
CLP = Classification Labelling Packaging Regulation ; Regulation (EC) No 1272/2008
CAS No. = Chemical Abstracts Service number
DMEL = Derived Minimal Effect Levels
DNEL = Derived No Effect Level
EC Number = EINECS and ELINCS Number (see also EINECS and ELINCS)
EU = European Union
IARC = International Agency for Research on Cancer
ISHL = Industrial Safety & Health Law
NIOSH = National Institute for Occupational Safety & Health
NTP = National Toxicology Program
OSHA = European Agency for Safety and Health at work
PBT = Persistent, Bioaccumulative and Toxic substance
PNEC(s) = Predicted No Effect Concentration(s)
REACH = Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (EC) No 453/2010
STP = Sewage Treatment Plant
SVHC = Substances of Very High Concern
vPvB = Very Persistent and Very Bioaccumulative
UN = United Nations
MARPOL = International Convention for the Prevention of Pollution from Ships (IMO)
IBC = Intermediate Bulk Container
CERCLA = Comprehensive Environmental Response, Compensation & Liability Act (US)
EPCRA = Emergency Planning and Community Right-to-Know Act (US)
EINECS = European Inventory of Existing Commercial chemical Substances
ELINCS = European List of Notified Chemical Substances

16.3 Key literature reference and sources for data :

UN Recommendations on the transport of dangerous goods 17th
Emergency Response Guidebook 2008;
http://phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/erg2008_eng.pdf

EU CLP; https://echa.europa.eu/information-on-chemicals/cl-inventory-database
REACH information on registered substances; https://echa.europa.eu/information-on-chemicals/registered-substances
U.S. National library of Medicine (NLM) Hazardous Substances Data Bank(HSDB); http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB
OECD SIDS; http://webnet.oecd.org/hpv/ui/Search.aspx
ECOTOX; http://cfpub.epa.gov/ecotox/
EPISUITE v4.11; https://www.epa.gov/tsca-screening-tools/download-epi-suitetm-estimation-program-interface-v411
Chemicalbook; http://www.chemicalbook.com/ProductIndex_EN.aspx
LookChem; http://www.lookchem.com/
Chemblink;http://www.chemblink.com/
SIGMA-ALDRICH; http://www.sigmaaldrich.com/united-states.html
Chemspider; http://www.chemspider.com/
IARC Monographs on the Evaluation of Carcinogenic Risks to Humans; http://monographs.iarc.fr
National Toxicology Program; http://ntp.niehs.nih.gov/results/dbsearch/
TOMES-LOLI®; http://www.rightanswerknowledge.com/loginRA.asp
American Conference of Governmental Industrial Hygienists TLVs and BEIs.
The Chemical Database -The Department of Chemistry at the University of Akron
EPA-IRIS; http://www.epa.gov/ncea/iris/index.html
NIOSH Pocket Guide; http://www.cdc.gov/niosh/npg/npgdcas.html

16.4 Classification and procedure used to derive the classification for mixtures according to Regulation(EC) 1272/2008(CLP) :

Classification according to Regulation (EC) Nr. 1272/2008	Classification procedure
Acute Tox. 4	Calculation method
Skin Irrit. 2	On basis of test data
Eye Irrit. 2	On basis of test data
Skin Sens. 1	On basis of test data
Carc. 1A	Expert judgement
Muta. 1B	On basis of test data
STOT RE 2	On basis of test data
Aquatic Acute 1	Calculation method
Aquatic Chronic 1	Calculation method

16.5 Relevant H-statements :

- H302 Harmful if swallowed
- H315 Causes skin irritation
- H317 May cause an allergic skin reaction
- H319 Causes serious eye irritation
- H340 May cause genetic defects
- H350 May cause cancer
- H373 May cause damage to organs through prolonged or repeated exposure
- H400 Very toxic to aquatic life
- H410 Very toxic to aquatic life with long lasting effects

16.6 Training advice :

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

16.7 Further information :

Data of sections 4 to 8, as well as 10 to 12, do not necessarily refer to the use and the regular handling of the product (in this sense consult package leaflet and expert information), but to release of major amounts in case of accidents and irregularities. The information describes exclusively the safety requirements for the product (s) and is based on the present level of our knowledge. This data does not constitute a uarantee for the characteristics of the product(s) as defined by the legal warranty regulations. "(n.a. = not applicable; n.d. = not determined)"

The data for the hazardous ingredients were taken respectively from the last version of the sub-contractor's safety data sheet.