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SECTION 1: Chemical product and company identification	
Product:	Lithium-Ion Battery Pack
Model:	RAML1225
Manufacturer:	Name: Nanjing ENZO Industry Co., Ltd. Address: No. 1788, Cheng Xin Avenue, Jiangning Economic & Technical Development Zone 211102 Nanjing, P. R. China
Telephone Number:	+0086-25-68998299
Fax Number:	+0086-25-57248686
Intended use:	Lithium-ion rechargeable battery pack for power tools.
Specifications:	Rated voltage: 10.8V d.c. Nominal voltage: 11.1V d.c. Rated capacity: 2500mAh Rated energy: 27.75Wh number / type of cells: 3 / SDI INR18650-25R8（3INR19/65）

SECTION 2: Hazards identification	
Route(s) of Entry	There is no hazard when the measures for handling and storage are followed.
Signs and Symptoms of Exposure	In case of battery damage, possible release of dangerous substances and a flammable gas mixture. OSHA Hazard Communication: This material is not considered hazardous by the OSHA Hazard Communication Standard 29CFR 1910.1200. Carcinogenicity (NTP): Not listed Carcinogenicity (IARC): Not listed Carcinogenicity (OSHA): Not listed
Special hazards for human health and environment	There is no hazard when the measures for handling and storage are followed. In case of battery damage, possible release of dangerous substances and a flammable gas mixture.

SECTION 3: 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	-	10~20	Lithium nickel oxide	Li2NiO2	Not classified
7440-44-0	231-153-3	-	10~20	Carbone	Carbon activated	Skin Sens. 1, H317 STOT RE 1, H372 Carc. 1A, H350i

7439-89-6	231-096-4	-	10~20	Iron	Fe	Not classified
12031-65-1	620-400-4	-	1~10	Lithium nickel dioxide	Lithium nickelate	Skin Sens. 1, H317 STOT RE 1, H372 ** Carc. 1A, H350i
7429-90-5	231-072-3	-	1~10	Aluminium	Al	Pyr. Sol. 1, H250 Water-react. 2, H261(pyrophoric) Flam. Sol. 1, H228 Water-react. 2, H261(stabilised)
12190-79-3	235-362-0	-	1~10	cobalt lithium dioxide	Lithium cobaltite	Flam. Liq. 3, H226 Acute Tox. 4, H332
7440-50-8	231-159-6	-	5~15	Copper	Cu	Acute Tox. 4, H302 Eye Irrit. 2, H319 Acute Tox. 3, H331 Aquatic Acute 1, H400 Aquatic Chronic 1, H410
616-38-6	210-478-4	-	1~10	dimethyl carbonate	Carbonic acid dimethyl ester	Flam. Liq. 2, H225
12057-17-9	601-724-5		1~10	Lithium Manganese (III,IV) oxide	LiMn2O4	Not classified
9002-88-4	618-339-3	-	1~10	Polyethylene	Ethene, homopolymer	Not classified
96-49-1	202-510-0	-	1~3	Ethylene carbonate	1,3-Dioxolan-2-one	Not classified
21324-40-3	244-334-7	-	1~3	lithium hexafluorophosphate(1-)	lithium hexafluorophospha te	Not classified
7782-42-5	231-955-3	-	1~3	Graphite	Grafito	Not classified
623-53-0	433-480-9	-	1~3	Ethyl methyl carbonate	EMC	Not classified
Trade secret	Not available	-	0.1~0.99	Trade secret 1	Gasket material	Not classified
7440-02-0	231-111-4	-	0.1~0.99	Nickel	Ni	Skin Sens. 1, H317 Carc. 2, H351

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						STOT RE 1, H372 Aquatic Chronic 3, H412
25640-14-6	607-767-6	-	0.1~0.99	1,4-Benzenedicarboxylic acid, 1,4-dimethyl ester, polymer with 1,4-cyclohexanedimethanol and 1,2-ethanediol	1,2 ethanediol	Not classified
9003-07-0	618-352-4	-	0.1~0.99	1-Propene, homopolymer	Polypropylene	Not classified
16812-54-7	240-841-2	-	0.1~0.99	Nickel sulphide	Nickel monosulfide	Skin Sens. 1, H317 Muta. 2, H341 STOT RE 1, H372 ** Aquatic Acute 1, H400 Aquatic Chronic 1, H410 Carc. 1A, H350i
26023-21-2	631-079-5	-	0.1~0.99	Poly[N,N'-(1,4-phenylene)-3,3',4,4'-benzophenonetetracarboxylic imide/amic acid]	Imide resin	Not classified
7440-21-3	231-130-8	-	0.1~0.99	Silicon	Ferro Silicon	Acute Tox. 3 *, H301 Acute Tox. 3 *, H311 Acute Tox. 3 *, H331
Trade secret	Not available	-	0.1~0.99	Trade secret 2	Electrolyte additive	Not classified
554-13-2	209-062-5	-	0.1~0.99	Lithium carbonate	Carbonic acid, dilithium salt	Not classified
1333-86-4	215-609-9	-	0.1~0.99	Carbon black	Carbon	Not classified
9003-55-8	618-370-2	-	0.1~0.99	1,3 Butadiene/styrene copolymers	Styrene, butadiene copolymer	Not classified
26337-35-9	Not available	-	0.1~0.99	Acetic acid ethenyl ester, polymer with carbon monoxide and ethene	Not available	Not classified

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9004-32-4	618-378-6	-	0.1~0.99	Carboxymethyl batteryulose sodium salt	Batteryulose, carboxymethyl ether, sodium salt	Not classified
110-61-2	203-783-9	-	0.1~0.99	Succinonitrile	Butanedinitrile	Not classified
11089-89-7	Not available	-	0.1~0.99	Aluminum lithium oxide (AlLiO)	Not available	Not classified

Further Information

Because of the battery structure the dangerous ingredients will not be available if used properly.

During charge process a lithium graphite intercalation phase is formed.

SECTION 4: First aid measures

General 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 batteries do not represent a danger to the health.

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, move 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 batteries 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.

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SECTION 5: 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 fire fighters	- 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 an overheated battery, wear heat-resistant protective equipment.

SECTION 6: 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 battery 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.

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SECTION 7: Handling and storage	
7.1 Precautions for safe handling	- In case of battery damage, possible release of dangerous substances and a flammable gas mixture. - The battery stores electrical energy and is capable of rapid energy discharge. - Battery battery 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 8: Exposure controls/personal protection

8.1 Control parameters
Occupational Exposure limits

Name	ACGIH regulation	Biological exposure index	OSHA regulation	NIOSH regulation	EU regulation
Graphite	TWA = 2mg/m3	Not available	Not applicable	Not applicable	Not applicable
Lithium nickelate	Not applicable	Not available	TWA = 1 mg/m3 (Nickel, metal and insoluble compounds (as Ni),Nickel, soluble compounds (as Ni),CAS.no7440-02-0)	TWA = Ca 0.015 mg/m3 (Nickel, metal and insoluble compounds (as Ni),Nickel, soluble compounds (as Ni),CAS.no7440-02-0)	Not applicable
Iron	Not applicable	Not available	Not available	Not available	Not available
Lithium manganese oxide	TWA = 10 mg/m³ (Magnesium oxide CAS.no 1309-48-4)	Not available	TWA = 15 mg/m3 (Magnesium oxide fume - Total Particulate CAS.no 1309-48-4)	TWA = 10 mg/m3 (Magnesium oxide fume - Total Particulate CAS.no 1309-48-4)	Not applicable
cobalt lithium dioxide	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Cobalt, Co	TWA = 0.02 mg/m3	Not available	TWA = 0.1 mg/m³	TWA 0.05 mg/m3	Not applicable
Copper	TWA = 0.2 mg/m³	Not available	Not available	Not available	Not available
dimethyl carbonate	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Aluminium	TWA = 1 mg/m³ (respirable particulate matter)	Not available	TWA = 15 mg/m³ (Aluminum Metal (as Al) Total dust) TWA = 5 mg/m³ (Aluminum Metal (as Al) Respirable fraction)	TWA = 1 mg/m³ (Aluminum Metal (as Al),Respirable fraction)	Not applicable

Polyethylene	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
1,3-Dioxolan-2-one	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
lithium hexafluorophosphate(1-)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
ethyl acetate	TWA = 400 ppm	Not available	TWA = 400 ppm TWA = 1400 mg/m³	TWA = 400 ppm	TWA = 734 mg/m³, TWA= 200 ppm, STEL = 1468 mg/m³, STEL = 400 ppm
Carbon black	TWA = 3mg/m³ (inhalable particulate matter)	Not available	TWA = 3.5 mg/m³	TWA = 3.5 mg/m³ Ca TWA = 0.1 mg PAHs/m3 [Carbon black in presence of polycyclic aromatic hydrocarbons (PAHs)]	Not applicable
Nickel	TWA = 1.5 mg/m³ (inhalable particulate matter)	Not available	TWA = 1 mg/m³ (metal and insoluble compounds (as Ni)) TWA = 1 mg/m³ (soluble compounds (as Ni))	Ca TWA = 0.015 mg/m3 (metal and insoluble compounds (as Ni)) Ca TWA = 0.015 mg/m3 (soluble compounds (as Ni))	Not applicable
lithium carbonate	Not applicable	Not available	Not applicable	Not applicable	Not applicable

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 equipments 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 9: Physical and chemical properties	
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 10: Stability and reactivity (USA, EU)	
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 battery damage, possible release of dangerous substances and a flammable gas mixture. - Containers may explode when heated. - Fire may produce irritating and/or toxic gases. - Some liquids produce vapors that may cause dizziness or suffocation. - 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 11: 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 : Not classified **(**ATEmix = 1001 mg/kg bw)

- Carbon : Rat LD50 > 2000 mg/kg (OECD Guideline 423, GLP)
- Iron : Rat LD50 = 98600 mg/kg (OECD Guideline 401, GLP)
- Copper : Rat LD50 = 481 mg/kg (OECD Guideline 401, GLP)
- Aluminium : Rat LD50 > 15900 mg/kg (Read-across)(OECD Guideline 401)
- Cobalt lithium dioxide : Rat LD50 > 5000 mg/kg (OECD Guideline 425, GLP)
- Dimethyl carbonate : Rat LD50 > 5000 mg/kg (male/female)(OECD Guideline 401, GLP)
- Polyethylene : Rat LD50 > 2000 mg/kg
- Ethylene carbonate : Rat LD50 = 10400 mg/kg (OECD Guideline 401)
- Lithium hexafluorophosphate(1-) : Rat LD50 = 50~300 mg/kg (OECD Guideline 423, GLP)
- Graphite : Rat LD50 > 2000 mg/kg (OECD Guideline 423, GLP)
- Ethyl methyl carbonate : Rat LD50 > 5000 mg/kg (OECD Guideline 401, GLP)
- Nickel : Rat LD50 > 9000 mg/kg (OECD Guideline 401, GLP)
- Nickel sulphide : Rat LD50 > 5000 mg/kg (OECD Guideline 401, GLP)
- Silicon : Rat LD50 > 5000 mg/kg (OECD Guideline 401, GLP)
- Trade secret 2 : Rat LD50 = ca. 500 mg/kg (OECD Guideline 423, GLP)
- Lithium carbonate : Rat LD50 = 525 mg/kg
- Carbon black : Rat LD50 > 10000 mg/kg (OECD Guideline 401, GLP)
- Carboxymethyl batteryulose sodium salt : Rat LD50 = 27000 mg/kg (Food Research. Vol. 13, Pg. 29,1948.)
- Succinonitrile : Rat LD50 = 300~2000 mg/kg (OECD Guideline 423, GLP)

Dermal : Not classified **(**ATEmix = 26400 mg/kg bw)

- Copper : Rat LD50 > 2000 mg/kg (OECD Guideline 402, GLP)

- Cobalt lithium dioxide : Rat LD50 > 2000 mg/kg (OECD Guideline 402, GLP)
- Dimethyl carbonate : Rabbit LD50 > 2000 mg/kg (male/female)(GLP)
- Ethylene carbonate : Rat LD50 = 2000 mg/kg (male/female)(OECD Guideline 402, GLP)
- Silicon : Rabbit LD50 > 5000 mg/kg
- Trade secret 2 : Rat LD50 > 2000 mg/kg (OECD Guideline 402, GLP)
- Lithium carbonate : Rabbit LD50 > 3000 mg/kg (OECD Guideline 402, GLP)
- Succinonitrile : Rat LD50 > 2000 mg/kg (OECD Guideline 402, GLP)

Inhalation : Not classified **(**ATEmix = 95.45 mg/L)
- Carbon : Rat LC0 = 8.5 mg/L / 1 hr (OECD Guideline 403)
- Iron : Rat LC50 > 100 mg/m³ / 6 hr (carbonyl iron)
- Copper : Rat LC50 > 5.11 mg/L / 4 hr (OECD Guideline 436, GLP)
- Aluminium : Rat LC50 > 0.888 mg/L / 4 hr (OECD Guideline 403)
- Dimethyl carbonate : Rat LC50 > 5.36 mg/L / 4 hr (male/female)(OECD Guideline 403, GLP)
- Ethylene carbonate : Rat LC0 = 730 mg/m³ / 8 hr (male/female)(OECD Guideline 403)
- Graphite : Rat LC50 > 2000 mg/m³ / 4 hr (OECD Guideline 403, GLP)
- Ethyl methyl carbonate : Rat LC50 > 17.6 mg/L / 4 hr (OECD Guideline 403, GLP)
- Nickel sulphide : Rat LC50 = 0.924 mg/L / 4 hr (OECD Guideline 403, GLP) (Read-across; Nickel subsulfide)
- Lithium carbonate : Rat LC50 > 2 mg/L / 4 hr (OECD Guideline 403, GLP)
- Carbon black : Rat LC0 = 4.6 mg/m³ / 4 hr (OECD Guideline 403)
- Carboxymethyl batteryulose sodium salt : Rat LC50 > 5800 mg/m³ / 4 hr (Toxicology Letters. Vol.(Suppl), Pg. 243, 1992.)
- Succinonitrile : Rat LC50 ≥ 2.67 mg/L / 4 hr (OECD Guideline 403)

Skin corrosion/ irritation : Not classified
- Carbon : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404, GLP)
- Iron : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404, GLP) (Fe2O3 83.5 %, FeO 12%, Co 4.5%)
- Copper : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404, GLP)
- Aluminium : In the skin irritation test using rabbits, the test material was not irritating. (Readacross)(OECD Guideline 404)
- Cobalt lithium dioxide : In in vitro skin irritation test, the test material was not irritating. (OECD Guideline 439)
- Dimethyl carbonate : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404)
- Polyethylene : In the skin irritation test using rabbits, the test material was mildly irritating.
- Ethylene carbonate : In the skin irritation test using rabbits, the test material was not classified.(OECD Guideline 404, GLP)
- Lithium hexafluorophosphate(1-) : In the skin irritation test using human skin model, the test material was corrosive. (EU Method B.40, GLP)
- Graphite : In the skin irritation test with rabbits, the test material was not irritating. (OECD Guideline 404, GLP)
- Ethyl methyl carbonate : In the skin irritation test using rabbits, the test material was not irritating.(OECD Guideline 404, GLP)
- Nickel : Industrial nickel dust causes nickel dermatitis.
- 1-Propene, homopolymer : Processes involved in production&processing of polyolefins are usually totally enclosed & type of accidents that may occur will be burns to skin or eyes, or asphyxiation or intoxication dueto inhalation of vapors escaping from leaks.
- Nickel sulphide : In the skin irritation test using rabbits, the test material was

	slightly irritating. The mean erythema score is 0.3 at 24 and 48h, and 0 at 72h. The effects are fully reversible within 72 hours. (OECD Guideline 404, GLP) (Read-across; Nickel subsulfide) - Silicon : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404, GLP) - Trade secret 2 : In the skin irritation test using human skin model, the test material was irritating.(OECD Guideline 439, GLP) - Lithium carbonate : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404, GLP) - Carbon black : In the skin irritation test using rabbits, the test material was not classified. (OECD Guideline 404) - Succinonitrile : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404) **Serious eye damage/ irritation :** Not classified - Carbon : In the eyes irritation test with rabbits, the test material was slightly irritating. but they were fully reversible within 7 days. (OECD Guideline 405, GLP)
	- Ethyl acetate : In the skin irritation test using rabbits, the test material was slightly irritating. (OECD Guideline 404) - Carbon black : In test on skin irritation with rabbits, skin irritations were not observed. (OECD TG 404) - Nickel; Raney nickel : Industrial nickel dust causes nickel dermatitis. - Lithium carbonate; Lithane : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404, GLP) **Serious eye damage/ irritation :** - 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; Fe_3O_4)(OECD TG 405, GLP) - Iron : In the eye irritation test using rabbits, the test material was not irritating. (OECD Guideline 405) - Copper : In the eyes irritation test with rabbits, the test material was irritating. but it was fully reversible within 7 days. (OECD Guideline 405, GLP) - Aluminium : In the eye irritation test using rabbits, the test material was not irritating. (Read-across) - Cobalt lithium dioxide : In the eye irritation test using rabbits, the test material was not irritating. (OECD Guideline 405, GLP) - Dimethyl carbonate : In the eye irritation test using rabbits, the test material was not irritating. (GLP) - Polyethylene : In the eye irritation test using rabbits, the test material was mildly irritating. - Ethylene carbonate : In the eye irritation test using rabbits, the test material was mildly irritating. (OECD Guideline 405, GLP) - Lithium hexafluorophosphate(1-) : In the eye irritation test using fertilised brown leghorn chicken eggs, the test material was severely irritating. (GLP) - Graphite : In the eyes irritation test with rabbits, the test material was slightly irritating. it was fully reversible within 7 days. (OECD Guideline 405, GLP) - Ethyl methyl carbonate : In the eye irritation test using rabbits, the test material was not irritating. (OECD Guideline 405, GLP) - Nickel : In the eyes irritation test with rabbits, the test material was slightly irritating. but they were fully reversible within 7 days. (OECD Guideline 405, GLP) - Nickel sulphide : In the eye irritation test using rabbits, the test material was mildly irritating. The effects are fully reversible within 72 hours. (OECD Guideline 405, GLP) (Read-across; Nickel subsulfide) - Silicon : In the eye irritation test using rabbits, the test material was not irritating. (OECD Guideline 405, GLP) (Read-across; Silica, precipitated, cryst.-free; CAS-No.: 112926-00-8) - Lithium carbonate : In the eyes irritation test with rabbits, the moderate

	conjunctivitis was observed. but they were fully reversible within 7 days. (conjunctivae score 2,2,1.3,1/3)(OECD Guideline 405, GLP) - Carbon black : In the eye irritation test using rabbits, the test material was not irritating. (OECD Guideline 405) - Succinonitrile : In the eye irritation test using rabbits, the test material was not irritating. The group mean 24, 48, 72-hour scores were 0 for corneal opacity, 0 for iritic effect and 0.07 for chemosis(fully reversible within 7 days). (OECD Guideline 405) **Respiratory sensitization :** Not classified - Aluminium: In the respiratory sensitization test using mice, the test material was not respiratory sensitization. (Read-across) - Carbon black: This material has not been tested in animals for sensitization effects on the respiratory tract. In humans, no cases of allergies were reported to the responsible occupational physicians. **Skin sensitization :** Not classified - Carbon : In the skin sensitization test using mice, the test material was not skin sensitizing. (OECD Guideline 429, GLP) - Iron : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing. (FeO.Fe2O3) - Copper : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing. (OECD Guideline 406, GLP) - Aluminium : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing. - Cobalt lithium dioxide : In the skin sensitization test using mice, the test material was not skin sensitizing. (OECD Guideline 429, GLP) - Dimethyl carbonate : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing. (OECD Guideline 406, GLP) - Polyethylene : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing. - Ethylene carbonate : In the skin sensitization test using guinea pigs, the test material was not classified. (OECD Guideline 406, GLP) - Lithium hexafluorophosphate(1-) : In the skin sensitization test using mice, the test material was not skin sensitizing. (OECD Guideline 429, GLP) - Graphite : In the skin sensitization test using mice, the test material was not skin sensitizing. (OECD Guideline 429, GLP) - Ethyl methyl carbonate : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing. (OECD Guideline 406, GLP) - Nickel : Nickel hypersensitivity dermatitis may be initiated by contact with nickel on the skin. - Nickel sulphide : In the skin sensitization test using guinea pigs, the test material was skin sensitising. Mean erythema score at 24 and 48 hours were 1.1 and 1.0, respectively.(Guinea pig mazimization test, GLP) (Read-across) - Trade secret 2 : In the skin sensitization test using mouse, the test material was skin sensitizing. (OECD Guideline 429, GLP) - Lithium carbonate : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing. (OECD Guideline 406, GLP) - Carbon black : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing. (OECD Guideline 406, GLP) - Succinonitrile : In the skin sensitization test using mice, the test material was not skin sensitizing. (OECD Guideline 429, GLP)
	Carcinogenicity : Not classified - Litium nickel oxide IARC: Group 1 (Nickel compounds) NTP: R (Nickel compounds) OSHA: Present (Nickel compounds)

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	ACGIH: A1 (Nickel insoluble inorganic compounds), A4 (Nickel soluble inorganic compounds) KOREA-ISHL: Carcinogenicity1A (Nickel(soluble compounds, insoluble inorganic compounds), CAS No.7440-02-0) - Lithium nickel dioxide IARC: Group 1 (Nickel compounds) NTP: R (Nickel compounds) OSHA: Present (Nickel compounds) ACGIH: A1 (Nickel insoluble inorganic compounds), A4 (Nickel soluble inorganic compounds) KOREA-ISHL: Carcinogenicity1A (Nickel(soluble compounds, insoluble inorganic compounds), CAS No. 7440-02-0) - Aluminium ACGIH: A4 - Cobalt lithium dioxide IARC: Group 2B (Cobalt and cobalt compounds) NTP: R (Cobalt compounds) OSHA: Present (Cobalt compounds) ACGIH: A3 (Cobalt inorganic compounds) KOREA-ISHL: Carcinogenicity2 (Cobalt inorganic compounds) - Polyethylene IARC: Group 3 - Graphite IARC: Group 3 - Nickel IARC: Group 2B (Nickel, metallic and alloys) NTP: R OSHA: Present ACGIH: A5 KOREA-ISHL: Carcinogenicity2 (metal) EU Regulation 1272/2008: Carc.2 - 1-Propene, homopolymer IARC: Group 3 - Nickel sulphide IARC: Group 1 (Nickel compounds) NTP: R (Nickel compounds) OSHA: Present (Nickel compounds) ACGIH: A1 (Nickel insoluble inorganic compounds), A4 (Nickel soluble inorganic compounds) KOREA-ISHL: Carcinogenicity1A (Nickel(soluble compounds, insoluble inorganic compounds), CAS No. 7440-02-0) - Carbon black IARC: Group 2B OSHA: Present ACGIH: A3 KOREA-ISHL: Carcinogenicity2 - 1,3 Butadiene/styrene copolymers IARC: Group 3 - Aluminum lithium oxide (AlLiO) IARC: Group 1 (Aluminum production) OSHA: Present (Aluminum production) ACGIH: A4 (Aluminum insoluble compounds)
	Mutagenicity : Not classified - Carbon : Negative reactions were observed in in vitro test(Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP)).

	- Iron : Negative reactions were observed in in vitro test(Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP)) - Copper : Negative reactions were observed in in vivo test(mammalian somatic battery study: cytogenicity/erythrocyte micronucleus(EU Method B.12, GLP)). - Aluminium : Negative reactions were observed in both in vivo (Mammalian Erythrocyte Micronucleus Test(OECD Guideline 474, GLP)) and in vitro (Mammalian battery gene mutation test(OECD Guideline 476, GLP)). - Cobalt lithium dioxide : Negative reactions were observed in in vitro tests(Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP) and Mammalian battery gene mutation Test(OECD Guideline 476, GLP))(WoE). Negative reactions were observed in in vivo tests(Mammalian Bone Marrow Chromosome Aberration Test(OECD Guideline 475) and Mammalian Erythrocyte Micronucleus Test(OECD Guideline 474, GLP)). - Dimethyl carbonate : Negative reactions were observed in in vivo (Mammalian Spermatogonial Chromosome Aberration Test (OECD Guideline 483, GLP)) - Polyethylene : No toxicity was observed in in vitro mutagenicity test using Salmonella typhimurium strain. - Ethylene carbonate : Negative reactions were observed in vitro (Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP)). - 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)). - Graphite : Negative reactions were observed in in vitro test(Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP)). - Ethyl methyl carbonate : Negative reactions were observed in vitro (Mammalian Chromosome Aberration Test (OECD Guideline 473, GLP)) -Negative reactions were observed in in vivo tests (Mammalian Erythrocyte Micronucleus Test(OECD Guideline 474, GLP) and Mammalian Bone Marrow chromosome Aberration Test(OECD Guideline 475, GLP)). - Nickel sulphide : Posiive reactions were observed in in vivo mammalian germ battery study.(Readacross) - Silicon : Negative reactions were observed in both in vivo (Mammalian Bone Marrow Chromosome Aberration Test(OECD Guideline 475, GLP)) - Trade secret 2 : Negative reactions were observed in in vivo (Mammalian Erythrocyte Micronucleus Test(OECD Guideline 474, GLP)). - Lithium carbonate : Negative reactions were observed in in vivo genetic toxicity test. - Carbon black : Positive reactions were observed in both in vitro (Chromosomal aberrations test (OECD Guideline 476, GLP)) and in vivo (ypoxanthine-guanine phosphoribosyl transferase gene (hprt) mutations in alveolar epithelial batteries). - Succinonitrile : Negative reactions were observed in in vitro tests(Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP) and Mammalian Chromosome Aberration Test(OECD Guideline 473, GLP)). Negative reactions were observed in in vivo tests(Mammalian Erythrocyte Micronucleus Test(OECD Guideline 474, GLP)) **Reproductive toxicity :** Not classified - Copper : In the reproductive toxicity and developmental toxicity test with rats, there were no significant adverse effects on reproductive parameters and no evidence of malformations at any doses. (OECD Guideline 416, 414, GLP) - Aluminium : In the reproductive toxicity and developmental toxicity test using rats, adverse effects were not observed, respectively. (OECD Guideline 422, GLP)(OECD Guideline 414) - Cobalt lithium dioxide : In the reproductive toxicity and developmental toxicity screening tests with rats, treatment with 300 mg cobalt powder/kg bw/day resulted in an increase of the post-implantation loss and a decrease in the live

	birth index. Treatment with 30 mg cobalt powder/kg bw/day resulted that the mean litter weight of pups was slightly reduced in a dose-related way (not significant at $p \leq 0.01$), significant only at 300 mg cobalt powder/kg bw/day. (NOAEL(P, F1) = 30 mg/kg bw/day) (OECD Guideline 422, GLP) - Dimethyl carbonate : In the reproductive toxicity test using rats, adverse effects were not observed,respectively. (OECD Guideline 415, GLP) In the developmental toxicity test using rabbits, adverse effects were not observed, respectively.(OECD Guideline 414, GLP) - Ethylene carbonate : In the reproductive toxicity test using mouse, adverse effects were not observed, respectively. (GLP) In the developmental toxicity test using rabbits, adverse effects were not observed, respectively. (GLP) - Lithium hexafluorophosphate(1-) : In the reproductive toxicity and developmental toxicity test using rats, adverse effects were not observed, respectively. (OECD Guideline 416, GLP)(OECD Guideline 414) - Graphite : In the reproductive toxicity with rats, there were no significant adverse effects on reproductive parameters. (OECD Guideline 422, GLP) - Ethyl methyl carbonate : In the reproductive toxicity and developmental toxicity test using rats, adverse effects were not observed, respectively. (OECD Guideline 414) - Nickel : In the reproductive toxicity and developmental toxicity test with rats, the number of live pups/litter was significantly decreased, pup mortality was significantly increased, and average pup body weight was significantly decreased at the 500 ppm dose level. (OECD Guideline 416, GLP) - 1,4-Benzenedicarboxylic acid, 1,4-dimethyl ester, polymer with 1,4-cyclohexanedimethanol: In the two-generation reproductive toxicity test with rats, developmental toxicity was evidenced by increased pup mortality and reduced body weight gain, including corresponding effects in the investigated organs, in pups treated at 500/350 mg/kg bw/day. (NOAEL(F) = 160 mg/kg bw/day) (OECD Guideline 416, GLP) - Nickel sulphide : In the reproductive toxicity with rats, the 500 ppm dose caused significant body weight depression of both mothers and pups and increased neonatal mortality during the postnatal development period. (equivalent or similar to OECD Guideline 416, GLP) (Nickel Chloride Hexahydrate (7791-20-0)). - Silicon : In the reproductive toxicity and developmental toxicity test using rats, adverse effects were not observed, respectively. (equivalent or similar to OECD Guideline 478) (Read-across; FDACompound 71-41 = Silene, calcium silicate (hydrated)) - Lithium carbonate : In the reproductive toxicity test with rats, no toxicological significant changes were detected. (OECD Guideline 416, GLP) - Carbon black : In the reproductive toxicity and developmental toxicity test using mice, adverse effects were not observed, respectively. (OECD Guideline 414, GLP) - Succinonitrile : In the reproductive toxicity and developmental toxicity tests with rats, there were no significant adverse effects on reproductive parameters. (OECD Guideline 416, GLP)
11.2 Specific target organ toxicity (single exposure)	Not classified - Carbon : In the acute oral toxicity test with rats, Animals visible exhibited labored breathing and intermittent gasping. (OECD Guideline 403) - Iron : In the acute oral toxicity test with rats, inactivity and depression of the animals within a few minutes after administration.(OECD Guideline 401, GLP) - Copper : In the acute oral toxicity test with rats, clinical signs observed included lethargy, prostrate posture, green coloured diarrhoea, voiding few faeces and moribundity. (OECD Guideline 401, GLP) In the acute inhalation toxicity test with rats, slight to moderate ataxia, slight to moderate tremor and slight to moderate dyspnoea were observed. (OECD Guideline 436, GLP) - Aluminium : In the acute oral toxicity test using rats, adverse effects were not

	observed, respectively.(Read-across)(OECD Guideline 401) In the acute inhalation toxicity test using rats, adverse effects were not observed, respectively. (OECD Guideline 403) - Cobalt lithium dioxide : In the acute toxicity tests with rats, there were no signs of gross toxicity, adverse pharmacologic effects, or abnormal behaviour. (OECD Guideline 425, 402, GLP) - Dimethyl carbonate : In the acute oral toxicity test using rats, hypoactivity, ataxia and loss of the righting reflex were observed. (OECD Guideline 401, GLP) In the acute dermal toxicity test using rabbits, adverse effects were not observed, respectively. (GLP) In the acute inhalation toxicity test using rats, adverse effects were not observed, respectively. (OECD Guideline 403, GLP) - Ethylene carbonate : In the acute dermal/inhalation toxicity test using rats, adverse effects were not observed, respectively. (OECD Guideline 402, GLP)(OECD Guideline 403) - Lithium hexafluorophosphate(1-) : In the acute oral toxcity test with rats, lethargy, hunched posture, uncoordinated movements, piloerection were observed. (OECD Guideline 423, GLP) - Graphite : In the acute oral toxicity test with rats, no signs of discomfort or toxicity effects. (OECD Guideline 423, GLP) - Ethyl methyl carbonate : In the acute oral and inhalation toxicity test using rats, ataxia, hunched posture, lethargy, decreased respiratory rate and laboured respiration are observed. (OECD Guideline 401, GLP) (OECD Guideline 403, GLP) - Nickel : In the acute oral toxicity test with rats, no signs of discomfort or toxicity effects. (OECD Guideline 423, GLP) - Nickel sulphide : In the acute inhalation toxicity test with rats, facial staining, ocular discharge, hypoactivity, a thin appearance, hunched posture, reduced fecal volume, cold limbs, and/or reduced food consumption was observed after dosing. (OECD Guideline 403, GLP) (Read-across; Nickel subsulfide) - Silicon : In the acute oral/dermal toxicity test using rats, adverse effects were not observed, respectively. (OECD Guideline 401, GLP) - Trade secret 2 : In the acute oral toxicity test with rats, piloerection, hypoactivity were observed during the 1st and 2nd step(300 mg/kg). convulsion, labored breathing immediately after dosing and then were found dead within 4 hours after dosing at the 3rd step(2,000 mg/kg). (OECD Guideline 423, GLP) - Lithium carbonate : In the acute inhalation toxicity test with rats, both increased secretory responses and labored breathing were observed. (OECD Guideline 403, GLP) - Carbon black : In the acute oral toxicity and acute inhalation toxicity test with rats, adverse effects were not observed, respectively. (OECD Guideline 401, GLP)(OECD Guideline 403) - Succinonitrile : In the acute oral toxicity test with rats, decrease in locomotor activity, emaciation, and soiled perinea region and mortality(2,000 mg/kg bw) were observed. (OECD Guideline 423, GLP)
11.3 Specific target organ toxicity (repeat exposure) :	Not classified - Carbon : In the repeated oral toxicity test, Slight lung inflammatory changes based on minimal increases in pulmonary neutrophils. (OECD Guideline 413, GLP) - Iron : In the repeated oral toxicity test with rats, the toxic effects include batteryular apoptosis or necrosis in heart, spleen and pancreas. (carbonyl iron) - Copper : In the repeated oral toxicity and inhalation toxicity test using rats, toxicity to organs was not observed. (EU Method B.26, GLP)(OECD Guideline 412, GLP) - Aluminium : In the repeated oral toxicity toxicity tests using rats, toxicity to organs was not observed. (Read-across)(OECD Guideline 422, GLP) In the repeated inhalation toxicity toxicity tests using rats, toxicity to organs was not observed. (OECD Guideline 413) - Cobalt lithium dioxide : In the repeated oral toxicity test in 90 days with rats,

	toxicity to organs was not observed. (OECD Guideline 408, GLP) - Dimethyl carbonate : In the repeated oral toxicity tests using rats, toxicity to organs was not observed. (OECD Guideline 408, GLP) - Polyethylene : Reported progressive systemic sclerosis in patients repeatedly exposed to chemicals. - Ethylene carbonate : In the repeated oral toxicity tests using rats, toxicity to organs was not observed. (OECD Guideline 452) - Graphite : In the repeated oral toxicity test with rats, no signs of discomfort or toxicity effects. (OECD Guideline 422, GLP) In the repeated inhalation toxicity test with rats, in the Graphite high-dose group, clearly adverse effects such as markedly increased incidence of interstitial fibrosis, were seen in the lung. (OECD Guideline 412, GLP) - Ethyl methyl carbonate : In the repeated oral toxicity test using rats, toxicity to organs was not observed. OECD Guideline 407, GLP) - Nickel : In the repeated oral toxicity test, metallic nickel is a potent respiratory tract toxicant that directly injures the lung and the nasal tissues of the rat, and produces marked secondary effects in the lung-draining lymph nodes. (OECD Guideline 413, GLP) - Nickel sulphide : In the repeated inhalation toxcity tests with rats, the test material had similar effects in the respiratory tract in that all produced atrophy of the olfactory epithelium and a chronic inflammation in the lung. (OECD Guideline 413)(Read-across; Ni3S2) - Silicon : In the repeated inhalation toxicity tests in 90 days using rats, repeated inhalation of silicon particles for 90 days did not induce any severe adverse effects in rats. (OECD Guideline 413, GLP)(Jetmilled Silicon) - Lithium carbonate : In the repeated oral toxicity test for human, toxicity to organs was not observed. - Carbon black : In the sub-chronic inhalation toxicity test using rats, there was clear evidence of inflammation and some alveolar epithelial battery hyperplasia and fibrosis at the high exposure group. In the mid-exposure group there was evidence of inflammation characterised by accumulation of neutrophils and macrophages within the alveolar spaces. - Succinonitrile : In the repeated oral toxicity test in 90 days with rats, No abnormal gross pathologocial findings were observed. (OECD Guideline 408, GLP)
11.4 Aspiration Hazard:	Not available

SECTION 12: 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 : ATEmix = 0.11 mg/ℓ
Fish	- Iron : 96hr-LC0(Danio rerio) > 100000 mg/L (OECD Guideline 203) - Copper : 96hr-LC50(Oncorhynchus mykiss) = 0.164 mg/L - Aluminium : 96hr-LC50(Pimephales promelas) = 1.16 mg/L (GLP) - Cobalt lithium dioxide : 96hr-LC50(Oncorhynchus mykiss) = 1.51 mg/L (ASTM) (Read-across; cobalt (II) chloride hexahydrate) - Dimethyl carbonate : 96hr-LC50((Danio rerio) ≥ 100 mg/L (OECD Guideline 203, GLP) - Ethylene carbonate : 96hr-LC50(Oncorhynchus mykiss) > 100 mg/L (OECD Guideline 203, GLP) - Lithium hexafluorophosphate(1-) : 96hr-LC50(Oncorhynchus mykiss) = 51

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	mg/L - Graphite : 96hr-LC50(Danio rerio) > 100 mg/L (OECD Guideline 203, GLP) - Ethyl methyl carbonate : 96hr-LC50(Oncorhynchus mykiss) > 100 mg/L (OECD Guideline 203, GLP) - Nickel : 96hr-LC50(Oncorhynchus mykiss) = 15.3 mg/L (measured) - Nickel sulphide : 96hr-LC50(Danio rerio) = 100~320 mg/L (OECD Guideline 203, GLP) - Trade secret 2 : 96hr-LC50(Danio rerio) = 6~60 mg/L (OECD Guideline 203, GLP) - Lithium carbonate : 96hr-LC50(Oncorhynchus mykiss) = 5.69 mg/L (OECD Guideline 203)(calculated for lithium ion) - Carbon black : 96hr-LC0(Danio rerio) = 1000 mg/L (OECD Guideline 203, GLP) - Succinonitrile : 96hr-LC50(Danio rerio) > 100 mg/L (OECD Guideline 203, GLP)
Crustacean	- Iron : 48hr-EC50(Daphnia magna) > 100 mg/L (OECD Guideline 202, GLP) - Copper : 48hr-LC50(Ceriodaphnia dubia) = 0.014 mg/L - Aluminium : 48hr-LC50(Ceriodaphnia dubia) = 0.72 mg/L (GLP) - Cobalt lithium dioxide : 48hr-LC50(Ceriodaphnia dubia) = 0.61 mg/L (USEPA 2002) (Read-across; cobalt (II) chloride hexahydrate) - Dimethyl carbonate : 48hr-EC50(Daphnia magna) > 100 mg/L (OECD Guideline 202, GLP) - Ethylene carbonate : 48hr-EC50(Ceriodaphnia dubia) = 5,900 mg/L - Lithium hexafluorophosphate(1-) : 48hr-LC50(Daphnia magna) > 100 mg/L (OECD Guideline 202, GLP) - Graphite : 48hr-EC50(Daphnia magna) > 100 mg/L (OECD Guideline 202, GLP) - Ethyl methyl carbonate : 48hr-EC50(Daphnia magna) > 100 mg/L (OECD Guideline 202, GLP) - Nickel : 48hr-LC50(Ceriodaphnia dubia) = 0.0744 mg/L (USEPA 2002, ASTM 2001, OECD 1984)(measured) - Nickel sulphide : 48hr-EC50(Daphnia magna) = 9.48 mg/L (OECD Guideline 202, GLP) - Trade secret 2 : 48hr-EC50(Daphnia magna) = 8.4 mg/L (OECD Guideline 202, GLP) - Lithium carbonate : 48hr-EC50(Daphnia magna) = 6.24 mg/L (OECD Guideline 202, GLP)(calculated for lithium ion) - Carbon black : 24hr-EC50(Daphnia magna) > 5600 mg/L (OECD Guideline 202, GLP) - Succinonitrile : 48hr-EC50(Daphnia magna) > 100 mg/L (OECD Guideline 202, GLP)
Algae	- Copper : 96hr-EC50(Chlamydomonas reinhardtii) = 0.047 mg/L - Aluminium : 72hr-EC50(Pseudokirchneriella subcapitata) = 0.2 mg/L (OECD Guideline 201, GLP) - Cobalt lithium dioxide : 72hr-EC50(Pseudokirchneriella subcapitata) = 0.144 mg/L (OECD Guideline 201) (Read-across) - Dimethyl carbonate : 72hr-EC50(Pseudokirchneriella subcapitata) > 100 mg/L (OECD Guideline 201, GLP) - Ethylene carbonate : 72hr-EC50(Pseudokirchneriella subcapitata) > 100

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	mg/L (OECD Guideline 201,GLP) - Lithium hexafluorophosphate(1-) : 96hr-EC50(Pseudokirchneriella subcapitata) > 100 mg/L (OECD Guideline 201, GLP) - Graphite : 72hr-EC50(Pseudokirchneriella subcapitata) > 100 mg/L (OECD Guideline 201, GLP) - Ethyl methyl carbonate : 72hr-EC50(Desmodesmus subspicatus) > 62 mg/L (OECD Guideline 201, GLP) - Nickel : 72hr-EC50(Pseudokirchneriella subcapitata) = 0.188 mg/L (equivalent or similar to OECD Guideline 201) - Nickel sulphide : 72hr-EC50(Pseudokirchneriella subcapitata) = 0.082~0.148 mg/L (OECD Guideline 201) - Silicon : 72hr-EC50(Pseudokirchneriella subcapitata) = ca. 250 mg/L (OECD Guideline 201) (Readacross) - Trade secret 2 : 72hr-EC50(Pseudokirchneriella subcapitata) = 32 mg/L (OECD Guideline 201, GLP) - Lithium carbonate : 72hr-EC50(Desmodesmus subspicatus) > 400 mg/L (OECD Guideline 201, GLP)(Li2CO3) - Carbon black : 72hr-EC50(Desmodesmus subspicatus) > 10000 mg/L (OECD Guideline 201, GLP)
Chronic toxicity	Not classified
Fish	- Copper : 30day-NOEC(*Perca fluviatilis*) = 0.188 mg/L (OECD Guideline 204) - Aluminium : 33day-NOEC(*Danio rerio*) = 0.0715 mg/L (OECD Guideline 210, GLP) - Cobalt lithium dioxide : 34day-NOEC(*Pimephales promelas*) = 0.21 mg/L (ASTM 2002) (Read-across; cobalt (II) chloride hexahydrate) - Lithium hexafluorophosphate(1-) : 22day-NOEC(*Pimephales promelas*) = 0.2 mg/L (EPA 540/86, GLP) - Nickel : 32day-NOEC(*Oncorhynchus mykiss*) = 0.134 mg/L (measured) - Nickel sulphide : 28day-NOEC(*Cyprinodon variegatus*) = 21.7 mg/L (ASTM 2004 and APHA 1998, GLP) - Lithium carbonate : 34day-NOEC(*Danio rerio*) = 2.87 mg/L (OECD Guideline 210, GLP)(calculated for lithium ion) - Succinonitrile : 28day-NOEC(*Rare Minnow*) > 10 mg/L (OECD Guideline 210, GLP)
crustacean	- Copper : 14day-NOEC(*Penaeus mergulensis and Penaeus monodon (prawns*) = 0.033 mg/L - Aluminium : 28day-NOEC(*Hyalella azteca*) = 0.0531 mg/L (GLP) - Cobalt lithium dioxide : 28day-NOEC(*Hyallela azteca*) = 0.00683 mg/L (OECD Guideline 211) (Readacross; Cobalt dichloride dihydrate) - Dimethyl carbonate : 21day-NOEC(*Daphnia magna*) = 25 mg/L (OECD Guideline 211, GLP) - Lithium hexafluorophosphate(1-) : 7day-NOEC(*Ceriodaphnia dubia*) = 2.55 mg/L (EPA/600/4-91/002) - Nickel : 7day-NOEC(*Ceriodaphnia dubia*) = 0.0053~0.0153 mg/L (equivalent or similar to EPA/600/4- 91/002)(measured) - Nickel sulphide : 10day-NOEC = 0.0202 mg/L (OECD Guideline 211) - Lithium carbonate : 21day-NOEC(*Daphnia magna*) = 1.7 mg/L (OECD Guideline 211, GLP) - Succinonitrile : 21day-NOEC(*Daphnia magna*) = 0.784 mg/L (OECD Guideline 211, GLP)

Algae	- Copper : 19day-NOEC(*giant kelp Macrocystis pyrifera*) = 0.0102 mg/L - Cobalt lithium dioxide : 72hr-NOEC(Pseudokirchneriella subcapitata) = 0.0322 mg/L (OECD Guideline 201) (Read-across) - Ethylene carbonate : 72hr-NOEC(Pseudokirchneriella subcapitata) = 100 mg/L (OECD Guideline 201,GLP) - Lithium hexafluorophosphate(1-) : 96hr-NOEC(Pseudokirchneriella subcapitata) = 22 mg/L (OECD Guideline 201, GLP) - Graphite : 72hr-NOEC(Pseudokirchneriella subcapitata) ≥ 100 mg/L (OECD Guideline 201, GLP) - Ethyl methyl carbonate : 72hr-NOEC(Desmodesmus subspicatus) = 62 mg/L (OECD Guideline 201, GLP) - Trade secret 2 : 72hr-NOEC(Pseudokirchneriella subcapitata) = 1 mg/L (OECD Guideline 201, GLP) - Lithium carbonate : 72hr-NOEC(Desmodesmus subspicatus) = 9.39 mg/L (OECD Guideline 201, GLP)(calculated for lithium ion) - Carbon black : 72hr-NOEC(Desmodesmus subspicatus) > 10000 mg/L (OECD Guideline 201, GLP) - Succinonitrile : 72hr-NOEC(Desmodesmus subspicatus) = 100 mg/L (OECD Guideline 201, GLP)
12.2 Persistence and degradability	**Persistence** - Carbon : Low persistency (log Kow is less than 4 estimated.) (log Kow = 0.78) (estimated) - Dimethyl carbonate : Low persistency (log Kow is less than 4 estimated.) (log Kow = 0.354) (20°C, 6.5 < pH < 7.5) - Ethylene carbonate : Low persistency (log Kow is less than 4 estimated.) (log Kow = 0.11) (20 °C, 5.33 < pH < 5.79) - Lithium hexafluorophosphate(1-) : Hydrolysis readily in contact with water. According to this it was not possible to determine the partition coefficient. (OECD Guideline 107, GLP) - Ethyl methyl carbonate : Low persistency (log Kow is less than 4 estimated.) (log Kow = 0.972) (40 °C, EU Method A.8, GLP) - Trade secret 2 : Low persistency (log Kow is less than 4 estimated.) (log Kow = -0.435) (OECD Guideline 107, GLP) - Succinonitrile : Low persistency (log Kow is less than 4 estimated.) (log Kow = -0.99) **Degradability** : - Polyethylene : (1) Polyethylene films incubated in aerobic and anaerobic bioreactors did not degrade over the course of 4-week to 25-week exposure periods. (2) Similar experiments conducted using aerobic and anaerobic bioreactors concluded no biodegradation of polyethylene occurred over 40-70 day incubation periods.
12.3 Bioaccumulative potential	**Bioaccumulation** - Carbon : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 2.433)(estimated) - Cobalt lithium dioxide : Bioaccumulation is expected to be high according to the BCF ≥ 500 (BCF =5500) - Dimethyl carbonate : Bioaccumulation is expected to be low according to the BCF < 500 (BCF < 3.2) - Lithium hexafluorophosphate(1-) : Bioaccumulation is expected to be low according to the BCF < 500(BCF = 53~58) - Nickel : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 45)

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	- Nickel sulphide : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 45) - Succinonitrile : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 3.162)(estimated) **Biodegradation** - 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 301C) - Ethylene carbonate : As well-biodegraded, it is expected to have low accumulation potential in living organisms(86% biodegradation was observed after 29 days) (OECD Guideline 301B) - Ethyl methyl carbonate : As well-biodegraded, it is expected to have low accumulation potential in living organisms(98% biodegradation was observed after 28 days) (GLP) - Trade secret 2 : As not well-biodegraded, it is expected to have high accumulation potential in living organisms(65% biodegradation was observed after 28 days) (OECD Guideline 301D, GLP) - Succinonitrile : As well-biodegraded, it is expected to have low accumulation potential in living organisms(99.4% biodegradation was observed after 14 days) (OECD Guideline 301A, GLP)
12.4 Mobility in soil	- Carbon : No potency of mobility to soil. (Koc = 8.823) (estimated) - Dimethyl carbonate : No potency of mobility to soil. (Koc = 2.9 ~ 6.65) (25 °C) - Ethylene carbonate : No potency of mobility to soil. (Koc = 11.9) - Ethyl methyl carbonate : No potency of mobility to soil. (Koc = 1.58) (OECD Guideline 121, GLP) - Succinonitrile : No potency of mobility to soil. (Koc = 14.52) (estimated)
12.5 Results of PBT and vPvB assessment :	Not available
12.6 Other adverse effects :	Not available

SECTION 13: Disposal considerations **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

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SECTION 14: Transportation information	
※ Only Lithium battery during transport: The product has passed the test items of UN Model Regulations, Manual of test and Criteria Section 38.3 and UN Model Regulations, SP188, 1.2m drop test. The total net weight of the Lithium batteries is less than 10 kg.	
IATA DGR (63th Edition):	Proper Shipping Name: Lithium Ion batteries UN Number: UN3480 Hazard Class:9 The product shall meet the General Requirements and Section IB of Packaging Instruction 965. According to 3.9.2.6.1(g) of IATA DGR(63th Edition), manufacturers and subsequent distributors of batteries or batteries manufactured after 30 June 2003 shall make available the test summary as specified in the Manual of Tests and Criteria, Part III, sub-section 38.3, paragraph 38.3.5.
IMO IMDG Code: (2020 Edition)	The product is not restricted to the other provisions of IMO IMDG Code according to special provision 188. According to 2.9.4.7 of IMDG Code(2020 Edition), manufacturers and subsequent distributors of batteries or batteries manufactured after 30 June 2003 shall make available the test summary as specified in the Manual of Tests and Criteria, Part III, sub-section 38.3, paragraph 38.3.5.
Lithium battery contained in the equipment during transport: The product has passed the test items of UN Model Regulations, Manual of test and Criteria Section 38.3.The total net weight of the lithium batteries is less than 5kg.	
IATA DGR (63th Edition):	The product shall meet the General Requirements and Section II of Packaging Instruction 966 or 967. According to 3.9.2.6.1(g) of IATA DGR (63th Edition), manufacturers and subsequent distributors of batteries or batteries manufactured after 30 June 2003 shall make available the test summary as specified in the Manual of Tests and Criteria, Part III, sub-section 38.3, paragraph 38.3.5.
IMO IMDG Code: (2020 Edition)	The product is not restricted to the other provisions of IMO IMDG Code according to special provision 188. According to 2.9.4.7 of IMDG Code(2020 Edition), manufacturers and subsequent distributors of batteries or batteries manufactured after 30 June 2003 shall make available the test summary as specified in the Manual of Tests and Criteria, Part III, sub-section 38.3, paragraph 38.3.5.

SECTION 15: Regulatory information Safety, health and environmental regulation/legislation specific for the substance or mixture	
EU regulations	**Authorisations and/or restrictions on use:** **Authorisations:** Not regulated **Restrictions on use:** - Nickel : Regulated **Other EU regulations:** **EU SVHC list**

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Regulatory information EU	**Labelling** **Hazardous components which must be listed on the label** As an article the product does not need to be labelled in accordance with EC directives or respective national laws. **EU regulatory information** 1999/13/EC (VOC): 0%
Foreign Regulatory Information	**External information :** **U.S.A management information (OSHA Regulation) :** Not regulated **U.S.A management information (CERCLA Regulation) :** - Copper : 5,000 lb - ethyl acetate : 5,000 lb - Nickel : 100 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) :** - Copper : Regulated - Aluminium : Regulated - Nickel : Regulated - lithium carbonate : Regulated - Cobalt, Co : Regulated **Substance of Roterdame Protocol :** Not regulated **Substance of Stockholme Protocol :** - lithium hexafluorophosphate(1-) : Regulated **Substance of Montreal Protocol :** Not regulated
KOREA regulations	**Occupational Safety and Health Act** - Litium nickel oxide : Threshold Limit Values (TLVs) chemicals, Hazardous Substances Subject to Control, Special management materials, Harmful Agents Subject to Work Environment Monitoring (Measurement cycle : 6 Months), Harmful Agents Subject to Workers Requiring Health Examination (Diagnostic cycle : 12 Months), Chemicals subject to permissible exposure limit - Iron : Threshold Limit Values (TLVs) chemicals, Hazardous Substances Subject to Control - Copper : Threshold Limit Values (TLVs) chemicals, Hazardous Substances Subject to Control, Harmful Agents Subject to Work Environment Monitoring (Measurement cycle : 6 Months), Harmful Agents Subject to Workers Requiring Health Examination (Diagnostic cycle : 12 Months) - Lithium nickel dioxide : Threshold Limit Values (TLVs) chemicals, Hazardous Substances Subject to Control, Special management materials, Harmful Agents Subject to Work Environment Monitoring (Measurement cycle : 6 Months), Harmful Agents Subject to Workers Requiring Health Examination (Diagnostic cycle : 12 Months), Chemicals subject to permissible exposure limit - Aluminium : Threshold Limit Values (TLVs) chemicals, Hazardous Substances Subject to Control, Harmful Agents Subject to Work Environment Monitoring (Measurement cycle : 6 Months), Harmful Agents Subject to Workers Requiring Health Examination (Diagnostic cycle : 12 Months) - Cobalt lithium dioxide : Threshold Limit Values (TLVs) chemicals, Hazardous Substances Subject to Control, Harmful Agents Subject to Work Environment Monitoring (Measurement cycle : 6 Months), Harmful Agents Subject to Workers Requiring Health Examination (Diagnostic cycle : 12 Months) - Lithium Manganese (III,IV) oxide : Threshold Limit Values (TLVs) chemicals, Hazardous Substances Subject to Control, Harmful Agents Subject to Work

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	Environment Monitoring (Measurement cycle : 6 Months), Harmful Agents Subject to Workers Requiring Health Examination (Diagnostic cycle : 12 Months) - Graphite : Threshold Limit Values (TLVs) chemicals, Harmful Agents Subject to Work Environment Monitoring (Measurement cycle : 6 Months), Harmful Agents Subject to Workers Requiring Health Examination (Diagnostic cycle : 12 Months) - Nickel : Threshold Limit Values (TLVs) chemicals, Hazardous Substances Subject to Control, Special management materials, Harmful Agents Subject to Work Environment Monitoring (Measurement cycle : 6 Months), Harmful Agents Subject to Workers Requiring Health Examination (Diagnostic cycle : 12 Months), Chemicals subject to permissible exposure limit - Nickel sulphide : Threshold Limit Values (TLVs) chemicals, Hazardous Substances Subject to Control, Harmful Agents Subject to Work Environment Monitoring (Measurement cycle : 6 Months), Harmful Agents Subject to Workers Requiring Health Examination (Diagnostic cycle : 12 Months), Chemical substance subject to authorization - Silicon : Threshold Limit Values (TLVs) chemicals - Carbon black : Threshold Limit Values (TLVs) chemicals
Chemicals Control Act	- Nickel sulphide : Toxic chemicals (97-1-130, 0.1%) - Succinonitrile : Toxic chemicals (2018-1-816, 25%)
Safety Control of Dangerous Substances Act	- Carbon : Non-dangerous goods - Iron : Iron content class 2, 500 kg - Copper : Non-dangerous goods - Aluminium : Metal powder class 2, 500 kg - Dimethyl carbonate : Petroleum class 4-1 (non-water soluble liquid), 200ℓ - Lithium Manganese (III,IV) oxide : Non-dangerous goods - Ethylene carbonate : Non-dangerous goods - Nickel : Non-dangerous goods - Silicon : Metal powder class 2, 500 kg - Trade secret 2 : Petroleum class 4-3 (non-water soluble liquid), 2000ℓ - Lithium carbonate : Non-dangerous goods - Carbon black : Non-dangerous goods - Carboxymethyl batteryulose sodium salt : Non-dangerous goods
Wastes Control Act	- Nickel sulphide : Controlled wastes Wastes toxic chemicals) - Succinonitrile : Controlled wastes Wastes toxic chemicals)
External information :	**Substance of Roterdame Protocol :** Not regulated **Substance of Stockholme Protocol :** 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 16: Other information **Product safety data sheet for PA0001N0006A/PA0001N0007A/PA001N0008A prepared in accordance with Regulation (EU) 2015/830 (REACH), Annex II, and OSHA 29 CFR 1910.1200**	
16.1 Indication of changes	**Date Updated :** 01 Jan 2021 **Version :** Rev. 00
16.2 Abbreviations and acronyms	**ACGIH** = American Conference of Government Industrial Hygienists **CLP** = Classification Labelling Packaging Regulation ; Regulation (EC) No 1272/2008

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	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

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16.3 Key literature reference and sources for data :	U.S. National library of Medicine (NLM) Hazardous Substances Data Bank (HSDB) LookChem; http://www.lookchem.com/ IUCLID: http://ecb.jrc.ec.europa.eu/IUCLID-DataSheets/7631905.pdf CHRIP(Chemical Risk Information Platform) EPISUITE v4.11; http://www.epa.gov/opt/exposure/pubs/episuitedl.html The Chemical Database -The Department of Chemistry at the University of Akron; http://ull.chemistry.uakron.edu/erd/ ECOTOX: http://cfpub.epa.gov/ecotox/ International Chemical Safety Cards (ICSC): http://www.nihs.go.jp/ICSC/ National Chemical Information System (http://ncis.nier.go.kr) Korea Dangerous Material Inventory Management System (http://hazmat.nema.go.kr) REACH information on registered substances; https://echa.europa.eu/information-on-chemicals/registered-substances EU CLP; https://echa.europa.eu/information-on-chemicals/cl-inventory-database NIOSH Pocket Guide; http://www.cdc.gov/niosh/npg/npgdcas.html 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 UN Recommendations on the transport of dangerous goods 17th American Conference of Governmental Industrial Hygienists TLVs and BEIs.
16.4 Classification and procedure used to derive the classification for mixtures according to Regulation(EC) 1272/2008(CLP) :	Not classified
16.5 Relevant H-statements :	Not applicable
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 guarantee 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.