Safety data sheet

SECTION 1: Chemical product and company identification

Product:	Lithium-Ion Battery Pack
Model:	RAML 1225
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. Rated capacity: 2500mAh Rated energy: 27Wh number / type of cells: 3 / INR18650-25++

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.

Safety data sheet

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)
7782-42-5	231-955-3	-	15~25	Graphite	Not available	Not classified
12031-65-1	Not available	-	15~25	Lithium nickelate	Not available	Skin Sens. 1, H317 STOT RE 1, H372 Carc. 1A, H350i
7439-89-6	231-096-4	-	10~20	Iron	Not available	Not classified
12057-17-9	Not available	-	5~15	Lithium manganese oxide	Not available	Pyr. Sol. 1, H250 Water-react. 2, H261
12190-79-3	235-362-0	-	1~10	cobalt lithium dioxide	Not available	Flam. Liq. 3, H226 Acute Tox. 4, H332
7440-50-8	231-159-6	-	1~10	Copper	Not available	Not classified
616-38-6	210-478-4	-	1~10	dimethyl carbonate	Not available	Flam. Liq. 2, H225
7429-90-5	231-072-3	-	1~10	Aluminium	Not available	Pyr. Sol. 1, H250 Water-react. 2, H261
9002-88-4	Not available	-	1~10	Polyethylene	Not available	Not classified
96-49-1	202-510-0	-	1~10	1,3-Dioxolan-2-one	Not available	Not classified
21324-40-3	244-334-7	-	1~10	lithium hexafluorophosphate(1-)	Not available	Not classified
141-78-6	205-500-4	-	0.1~1	ethyl acetate	Not available	Flam. Liq. 2, H225 Eye Irrit. 2, H319 STOT SE 3, H336
1333-86-4	215-609-9	-	0.1~1	Carbon black	Not available	Not classified
7440-02-0	231-111-4	-	0.1~1	Nickel	Not available	Skin Sens. 1, H317 Carc. 2, H351 STOT RE 1, H372 Aquatic Chronic 3, H412
554-13-2	209-062-5	-	0.1~1	lithium carbonate	Not available	Not classified
872-50-4	212-828-1	-	0.1~1	1-Methyl-2-pyrrolidinone	Not available	Skin Irrit. 2, H315 Eye Irrit. 2, H319 STOT SE 3, H335 Repr. 1B, H360D

Full text of each relevant R phrase can be found in heading 16.

Safety data sheet

Further Information	For information purposes: (*) Main ingredients: Lithium hexafluorophosphate, organic arbonates 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. Mercury content: Hg < 0.1mg/kg Cadmium content: Cd < 1mg/kg Lead content: Pb< 10mg/kg

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.

Safety data sheet

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 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 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.

Safety data sheet

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

Safety data sheet

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

Safety data sheet

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

Safety data sheet

ppearance	**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

Safety data sheet

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.

Safety data sheet

11.1 Information on toxicological effects	**Acute toxicity** **Oral :** ATEmix = 1770 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 TG 401) - Copper : Rat LD_{50} > 2,500 mg/kg (Cupric oxide; read across)(OECD TG 423, GLP) - Dimethyl carbonate : Rat LD_{50} > 5,000 mg/kg (male/female) (OECD Guideline 401) - Aluminum : Rat LD_{50} > 15,900 mg/kg (OECD TG 401)(Fumed alumina; read across) - Polyethylene : Rat LD_{50} > 2,000 mg/kg - 1,3-Dioxolan-2-one : Rat LD_{50} = 10,400 mg/kg (male) (OECD Guideline 401) - Lithium hexafluorophosphate(1-) : Rat LD_{50} = 50 ~ 300 mg/kg (Female)(OECD Guideline 423, GLP) - Ethyl acetate : Rat LD_{50} = 4,934 mg/kg - Carbon black : Rat LD_{50} > 8,000 mg/kg (OECD TG 401) - Nickel; Raney nickel : Rat LD_{50} > 9,000 mg/kg (male/female) (OECD Guideline 401, GLP) - Lithium carbonate;Lithane : Rat LD_{50} = 525 mg/kg **Dermal :** - Copper : Rat LD_{50} > 2,000 mg/kg (OECD TG 402, GLP) - Dimethyl carbonate : Rabbit LD_{50} > 2,000 mg/kg (male/female) - 1,3-Dioxolan-2-one : Rat LD_{50} > 2,000 mg/kg (male/female) (OECD Guideline 402) - Ethyl acetate : Rabbit LD_{50} > 20,000 mg/kg (male) - Lithium carbonate;Lithane : Rabbit LD_{50} > 3,000 mg/kg (male/female) (OECD Guideline 402) **Inhalation :** - Graphite : Rat LD_{50} > 2 mg/L/4hr (male/female) (OECD Guideline 403) - Fe : Rat LC_{50} > 100 mg/m³/6hr - Dimethyl carbonate : Rat LD_{50} > 5.36 mg/L/4hr (male/female) (OECD Guideline 403) - Aluminum : Rat LC_{50} > 0.888 mg/L/4hr (analytical) (OECD TG 403) - 1,3-Dioxolan-2-one : Rat LC_0 = 730 mg/m³ /8hr - Ethyl acetate : Rat LCL_0 > 6000 ppm (male/female) - Carbon black : Rat LC_{50} > 0.005 mg/L/4hr - Lithium carbonate;Lithane : Rat LC_{50} > 2 mg/L/4hr (male/female) (OECD Guideline 403) **Skin corrosion/ irritation :** - 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; Fe3O4)(OECD TG 404, GLP) - Copper : In test on skin irritation with rabbits, skin irritations were not observed. (OECD TG 404, GLP) - Dimethyl carbonate : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404) - 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 TG 404)(Read across; aluminium oxide) - 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. - 1,3-Dioxolan-2-one : 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, the test material was corrosive. (EU Method B.40, GLP)

Safety data sheet

	- 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; Fe3O4)(OECD TG 405, GLP) - Copper : In test on skin irritation with rabbits, skin irritations were not observed. (OECD TG 405, GLP) - Dimethyl carbonate : In the eye irritation test using rabbit, the test material was not irritating. (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) - Polyethylene : Mild irritants were observed in eye irritation test with rabbits. (Score 11.7/110) - 1,3-Dioxolan-2-one : In the eye irritation test using rabbit, the test material was moderately 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) - Ethyl acetate : In the eyes irritation test using rabbits, the test material was not irritating. (OECD Guideline 405) - Carbon black : In test on eyes irritation with rabbits, eyes irritations were snot observed. (OECD TG 405) - Lithium carbonate;Lithane : In the eye irritation test using rabbit, the test material was moderately irritating. (OECD Guideline 405, GLP) **Respiratory sensitization :** - Aluminum : Al2O3 was the least inflammatory material tested and led to only weak effects on the mouse lung. (Read across; Aluminium oxide) - Carbon black : In respiratory sensitization test with mice, it did not induce respiratory sensitization. **Skin sensitization :** - 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, Fe2O3) - Copper : In maximization test on skin sensitization with guinea pig, skin sensitization was not observed. (OECD TG 406, GLP) - Dimethyl carbonate : In the skin sensitization test using guinea pig, this material was not skin sensitizing. (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) - Polyethylene : No reactions were observed in skin sensitization test with guinea pigs. - 1,3-Dioxolan-2-one : In the skin sensitization test using guinea pig, this material was not classified. (OECD Guideline 406, GLP) - Lithium hexafluorophosphate(1-) : In the skin sensitization test using mice, the test material was not skin sensitization. (OECD Guideline 429, GLP) - Ethyl acetate : In the skin sensitization test using guinea pig, this material was not skin sensitizing. (OECD Guideline 406) - Carbon black : In skin sensitization test with guinea pig, it did not induce skin sensitization. (OECD TG 406, GLP) - Nickel; Raney nickel : Nickel hypersensitivity dermatitis may be initiated by contact with nickel on the skin. - Lithium carbonate;Lithane : In the skin sensitization test using guinea pig, this material was not skin sensitizing. (OECD Guideline 406, GLP)

Safety data sheet

Carcinogenicity :
IARC
- Nickel : Group 2B
- Cobalt and cobalt compounds : Group 2B
- Polyethylene : Group 3
- Carbon black : Group 2B

NTP
- Nickel : R
- Iron : Present

OSHA
- Nickel : Present

ACGIH
- Nickel : A5
- Cobalt and cobalt compounds : A3
- Aluminum : A4
- Carbon black : A3

KOREA-ISHL
- Cobalt and inorganic compounds : 2
- Carbon black : 2 - Nickel : 1A

EU
- Lithium nickelate : Carc.1A
- 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).

Mutagenicity :

- Graphite : Negative reactions were observed in vitro (Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP)). - Fe : In mammalian battery gene mutation assay electrolytic iron, positive carbonyl iron exhibited a cytotoxic and mutagenic response (OECD TG 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) - 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)) - Aluminum : Negative reactions were observed in vitro (mammalian battery gene mutation assay with mouse lymphoma L5178Y batteries(OECD TG 476, GLP)) and in vivo (micronucleus assay with rats (OECD TG 474, GLP)). (Aluminium hydroxide, aluminium chloride, aluminum oxide; read across) - Polyethylene : Negative reactions were observed in Ames test using Salmonella typhimurium and Escherichia coli. - 1,3-Dioxolan-2-one : Negative reactions were observed in vitro (mammalian battery gene mutation assay (OECD Guideline 476, 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)). - Ethyl acetate : Negative reactions were observed in both in vitro(Bacterial Reverse Mutation Assay(OECD Guideline 471)) and in vivo (Mammalian Erythrocyte Micronucleus Test(OECD Guideline 474)). - Carbon black : Negative reactions were observed in both in vitro(Bacterial gene mutation test(OECD TG 471, GLP), Chromosomal aberrations test(OECD TG 476)) and in vivo(DNA damage and/or repair test). - Lithium carbonate;Lithane : Negative reactions were observed in vitro (Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP)).

Safety data sheet

Reproductive toxicity :
- Copper : In reproductive toxicity with rats, there were no effects considered (up to 1500 ppm). (OECD TG 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 TG 422, GLP)(Aluminium chloride; read across) - 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)) - Carbon black : No adverse effects on the reproductive function are expected.(OECD TG 414)

Specific target organ toxicity (single exposure) :
- 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 TG 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 TG 401)(Fumed alumina; read across) - Polyethylene : No test substance-related toxic effects were observed in an acute oral toxicity study with rats. - 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) - 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)

Specific target organ toxicity (repeat exposure) :
- 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. - Polyethylene : No significant adverse effects were observed in subchronic (90-day) oral toxicity study with rats and dogs. - 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)

Safety data sheet

	- 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.
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 = 0.14 mg/ℓ
Fish	- Graphite : 96hr-LC_{50} (*Brachydanio rerio*) > 100 mg/L - Fe : 96hr-LC_{50} > 10000 mg/L (OECD TG 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) - 1,3-Dioxolan-2-one : 96hr-LC_{50} > 100 mg/L (OECD Guideline 203, GLP) - 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 - Ethyl acetate : 96hr-LC_{50} = 230 mg/L - Carbon black : 96hr-LC_{0} = 1000 mg/L (OECD TG 203, GLP) - 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)
Crustacean	- Graphite : 48hr-EC_{50} (*Daphnia magna*) > 100 mg/L - Fe : 48hr-EC_{50} > 100 mg/L (OECD TG 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) - 1,3-Dioxolan-2-one : 48hr-EC_{50} > 100 mg/L (OECD Guideline 202, GLP) - 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) - Ethyl acetate : 24hr-EC_{50} = 2500 mg/L - Carbon black : 24hr-EC_{50} > 5600 mg/L (OECD TG 202, GLP) - 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)

Safety data sheet

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 - Aluminum : 72hr-EC_{50} = 0.0169 mg/L (OECD TG 201), (Read across; CAS 13473-90-0) - 1,3-Dioxolan-2-one : 72hr-EC_{50} > 100 mg/L (OECD Guideline 201, GLP), 72hr-NOEC(*Selenastrum capricornutum*) = 100mg/L(OECD Guideline 201, GLP) - Lithium hexafluorophosphate(1-) : 96hr-EC_{50} > 100 mg/L ; 96h-NOEC = 22 mg/L (OECD Guideline 201, GLP) - Carbon black : 72hr-EC_{50} > 10000 mg/L , 72hr-NOEC > 10,000mg/l (OECD TG 201, GLP) - Lithium carbonate;Lithane : 72hr-EC_{50} > 400 mg/L
12.2 Persistence and degradability	**Persistence** - Graphite : Low persistency (log Kow is less than 4 estimated.) (Log Kow = 0.78) - Aluminum : Low persistency (log Kow is less than 4 estimated.) (Log Kow = 0.33) (estimated) - 1,3-Dioxolan-2-one : Low persistency (log Kow is less than 4 estimated.) (Log Kow = 0.11) (20 °C, pH> 5.33 - < 5.79)(EU Method A.8, GLP) - Lithium hexafluorophosphate(1-) : Low persistency (log Kow is less than 4 estimated.) (Log Kow = 0.354) (20 °C, pH > 6.5 - < 7.5)(OECD Guideline 107, GLP) - Ethyl acetate : Low persistency (log Kow is less than 4 estimated.) (Log Kow = 0.68) **Degradability** : Not available **C. Bioaccumulative potential** **Bioaccumulation** - Graphite : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 2.433) - cobalt lithium dioxide : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 23) (Read across; 57CoCl) - Copper : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 0.02 ~ 20) - Dimethyl carbonate : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 3.2) - Aluminum : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 3.162) (estimated) - 1,3-Dioxolan-2-one : 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) - Ethyl acetate : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 30) - Nickel; Raney nickel : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 70) **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 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) - 1,3-Dioxolan-2-one : As well-biodegraded, it is expected to have low accumulation potential in living organisms (70% ~ 80% biodegradation was observed after 10 days) (OECD Guideline 301 A, GLP) - 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) - Ethyl acetate : As well-biodegraded, it is expected to have low accumulation potential in living organisms (= 62% biodegradation was observed after 10 days) - Carbon black : carbon black is an inorganic substance and will not biodegraded by microorganisms

Safety data sheet

12.4 Mobility in soil	- 1,3-Dioxolan-2-one : Low potency of mobility to soil. (Koc = 3.219) (estimated) - Ethyl acetate : Low potency of mobility to soil. (Koc = 6) - Nickel; Raney nickel : Low potency of mobility to soil. (Koc = 2.86)
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

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 (63thEdition):	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(63thEdition), 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.

Safety data sheet

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 (62th 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(62th 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: (2018 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(2018 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**
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
15.2 Chemical safety assessment :	- No chemical safety assessment has been carried out for this product by the supplier.

Safety data sheet

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 **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

Safety data sheet

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.