SAFETY DATA SHEET

1. Identification of the substance or mixture and of the supplier

A. GHS product identifier : MODEL CS112 (112Ah capacity)

B. Recommended use of the chemical and restrictions on use

Recommended use : Lithium-Ion battery

Restrictions on use : Use for recommended use only.

C. Supplier

Company name : SAMSUNG SDI Co., Ltd.

Address : 150-20, Gongse-ro, Giheung-gu, Yongin-si, Gyeonggi-do, Korea

Emergency phone number : + 1-800-424-9300: US and Canada / 1-703-527-3887: International (Customer Number : 19510)

Respondent : CHEMTREC 24/7 Emergency Call Center

Fax : Not available

2. Hazards identification

※ 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 pre cautions 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.

A. GHS classification of the substance/mixture

Not classified according to OSHA 29 CFR 1910.1200

B. GHS label elements, including precautionary statements

Pictogram and symbol :

Not applicable

Signal word :

Not applicable

Hazard statements :

Not applicable

Precautionary statements

Precaution :

Not applicable

Treatment :

Not applicable

Storage :

Not applicable

Disposal :

Not applicable

C. Other hazard information not included in hazard classification :

- Empirical data on effects on humans : If appropriately handled and if in accordance with the general hygienic rules, no damages to health have become known.

3. Composition/information on ingredients

Chemical Name	Common Name(Synonyms)	CAS number	EC number	Content (%)
Cobalt lithium manganese nickel oxide	-	182442-95-1	695-690-9	30~40
Graphite	Grafito	7782-42-5	231-955-3	15~25
1-methyl-2-pyrrolidone	N-Methyl Pyrrolidione	872-50-4	212-828-1	10-20
Copper	Cu	7440-50-8	231-159-6	3~10
Aluminium	Al	7429-90-5	231-072-3	1~10
Carbon Black	Carbon	1333-86-4	215-609-9	0.1~1
Lithium borofluoride	-	14283-07-9	238-178-9	0.1~1
Trade secret 1	-	Trade secret	Trade secret	1~10
Trade secret 2	-	Trade secret	Trade secret	1~10
Trade secret 3	-	Trade secret	Trade secret	1~10
Trade secret 4	-	Trade secret	Trade secret	0.1~1
Trade secret 5	-	Trade secret	Trade secret	1~10
Trade secret 6	-	Trade secret	Trade secret	0.1~1

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 cells do not represent a danger to the health.

A. Eye contact

- In case of contact with substance, immediately flush eyes with running water at least 20 minutes.

B. Skin contact

- In case of contact with substance, immediately flush skin with running water at least 20 minutes.
- Remove and isolate contaminated clothing and shoes.
- Wash contaminated clothing and shoes before reuse.
- Get immediate medical advice/attention.

C. Inhalation

- Specific medical treatment is urgent.
- Move victim to fresh air.
- Administer oxygen if breathing is difficult.

D. Ingestion

- Do not let him/her eat anything, if unconscious.
- Get immediate medical advice/attention.

E. Indication of immediate medical attention and notes for physician

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

F. Most important symptoms and effects, both acute and delayed

Not available

5. Fire fighting measures

A. Suitable (and unsuitable) 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.

B. Specific hazards arising from the chemical

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

C. Special protective equipment and precautions 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 a overheated battery, wear heat-resistant protective equipment.

6. Accidental release measures

A. Personal precautions, protective equipment and emergency procedures

- Eliminate all ignition sources.
- Stop leak if you can do it without risk.
- Please note that materials and conditions to avoid.
- Ventilate the area.
- Do not touch or walk through spilled material.

B. Environmental precautions and protective procedures

- Prevent entry into waterways, sewers, basements or confined areas.

C. The methods of purification and removal

- With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.

7. Handling and storage

A. Precautions for safe handling

- Avoid short circuiting the cell.
- Avoid mechanical damage of the cell.
- Do not open or disassemble.
- Please note that materials and conditions to avoid.
- Wash thoroughly after handling.
- Please work with reference to engineering controls and personal protective equipment.
- Be careful to high temperature.

B. Conditions for safe storage

- Store in a closed container.
- Store in cool and dry place.

8. Exposure controls/personal protection

A. Occupational Exposure limits

ACGIH regulation :

- Cobalt lithium manganese nickel oxide : TWA = 0.2 mg/m^3 (inhalable particulate matter, as Ni)(Nickel insoluble inorganic compounds), TWA = 0.1 mg/m^3 (inhalable particulate matter, as Ni)(Nickel soluble inorganic compounds), TWA = 0.02 mg/m^3 (as Co)(Cobalt inorganic compounds), TWA = 0.02 mg/m^3 (respirable particulate matter, as Mn); 0.1 mg/m^3 (inhalable particulate matter, as Mn)(Manganese inorganic compounds)
- Aluminium : TWA = 1 mg/m^3 (respirable particulate matter)(Aluminum, Aluminum insoluble compounds)
- Copper : TWA = 0.2 mg/m^3 (Copper fume), TWA = 1 mg/m^3 (Copper dust and mist, Copper compounds as Cu)
- Carbon black : TWA = 3 mg/m^3 (inhalable particulate matter)

OSHA regulation :

- Cobalt lithium manganese nickel oxide : TWA = 1 mg/m^3 (Nickel compounds), C = 5 mg/m^3 (Manganese compounds)

- Aluminium : TWA = 15 mg/m^3 (Aluminum metal (as Al), Total dust), 5 mg/m^3 (Respirable fraction)
- Copper : TWA = 0.1 mg/m^3 (Copper Fume (as Cu)), 1 mg/m^3 (Dusts and mists (as Cu), Cotton dust)
- Carbon black : TWA = 3.5 mg/m^3

NIOSH regulation :

- Cobalt lithium manganese nickel oxide : TWA = 0.015 mg/m³ (Nickel metal and other compounds, as Ni), TWA = 1 mg/m³, STEL = 3 mg/m³ (Manganese compounds)
- Aluminium : TWA = 10 mg/m^3 (total), 5 mg/m^3 (resp)
- Copper : TWA = 1 mg/m^3 (Copper (dusts and mists, as Cu), other copper compounds (as Cu) except Copper fume)
- Carbon black : TWA = 3.5 mg/m^3

Biological exposure index : Not available

B. Appropriate engineering controls

- Provide local exhaust ventilation system or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

C. Personal protective equipment

Respiratory protection :

- Wear NIOSH or European Standard EN 149 approved full or half face piece (with goggles) respiratory protective equipment when necessary.
- In case exposed to particulate material, the respiratory protective equipment as follow are recommended.
; facepiece filtering respirator or air-purifying respirator, high-efficiency particulate air(HEPA) filter media or respirator equipped with powered fan, filter media of use(dust, mist, fume)
- In lack of oxygen(< 19.5%), wear the supplied-air respirator or self-contained oxygen breathing apparatus.

Eye protection :

- Wear facepiece with goggles to protect.
- An eye wash unit and safety shower station should be available nearby work place.
- Wear breathable safety goggles to protect from particulate material causing eye irritation or other disorder.
- An eye wash unit and safety shower station should be available nearby work place.

Hand protection :

- Wear chemical resistant gloves.
- Wear appropriate protective gloves by considering physical and chemical properties of chemicals.

Body protection :

- Wear appropriate protective chemical resistant clothing.
- Wear appropriate protective clothing by considering physical and chemical properties of chemicals.

9. Physical and chemical properties

A. Appearance

Description : Solid
Color : Various
B. Odor : Odorless
C. Odor threshold : Not available
D. pH : Not available
E. Melting point/freezing point : Not available
F. Initial boiling point and boiling range : Not available
G. Flash point : Not available
H. Evaporation rate : Not available
I. Flammability (solid, gas) : Not available
J. Upper/lower flammability or explosive limits : Not available
K. Vapor pressure : Not available
L. Solubility (ies) : Insoluble
M. Vapor density : Not available
N. Specific gravity : Not available
O. Partition coefficient: n-octanol/water : Not available
P. Auto ignition temperature : Not available
Q. Decomposition temperature : Not available
R. Viscosity : Not available
S. Molecular weight : Not available

10. Stability and reactivity

A. Chemical stability and Possibility of hazardous reactions
- Stable in general.
- In case of open cells, there is the possibility of hydrofluoric acid and carbon monoxide release.
- Fire may produce irritating and/or toxic gases.
- Inhalation of material may be harmful.

B. Conditions to avoid
- Ignition sources (heat, sparks or flames)

C. Incompatible materials
- Combustibles

D. Hazardous decomposition products
- No decomposition if stored and applied as directed.
- Irritating and/or toxic gases

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 pre cautions 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.

A. Information on the likely routes of exposure

Not available

B. Information of Health Hazardous

Acute toxicity

Oral : Not classified (ATEmix = 4,721 mg/kg)

- Cobalt lithium manganese nickel oxide : Rat LD_{50} > 2,000 mg/kg(NCIS)
- Aluminium : Rat LD_{50} > 15,900 mg/kg(Read-across)(OECD Guideline 401)
- Graphite : Rat LD_{50} > 2,000 mg/kg(OECD Guideline 423, GLP)
- 1-methyl-2-pyrrolidone : Rat LD50 = 4,150 mg/kg(OECD Guideline 401)
- Copper : Rat LD_{50} = 481 mg/kg(OECD Guideline 401, GLP)
- Trade secret 1 : Rat LD_{50} > 5,000 mg/kg(OECD Guideline 401, GLP)
- Trade secret 2 : Rat LD_{50} = 10,400 mg/kg(OECD Guideline 401)
- Trade secret 3 : Rat LD_{50} > 5,000 mg/kg(male/female)(OECD Guideline 401, GLP)
- Trade secret 4 : Rat LD50 = 500 mg/kg (male)(OECD Guideline 423)
- Trade secret 5 : Rat LD_{50} = 50~300 mg/kg(OECD Guideline 423, GLP)
- Lithium borofluoride : Rat LD_{50} = 300 mg/kg(OECD Guideline 423, GLP)
- Trade secret 6 : Rat LD_{50} = 300 mg/kg(OECD Guideline 423, GLP)
- Carbon black : Rat LD_{50} > 10,000 mg/kg(OECD Guideline 401, GLP, ECHA)

Dermal : Not classified (ATEmix = 11,111 mg/kg)

- 1-methyl-2-pyrrolidone : Rat LD50 > 5,000 mg/kg(OECD Guideline 402)
- Copper : Rat LD_{50} > 2,000 mg/kg(OECD Guideline 402, GLP)
- Trade secret 2 : Rat LD_{50} = 2,000 mg/kg(male/female)(OECD Guideline 402, GLP)
- Trade secret 3 : Rabbit LD_{50} > 2,000 mg/kg(male/female)(GLP)
- Trade secret 4 : Rat LD50 > 2,000 mg/kg (male/female) (OECD Guideline 402)
- Carbon black : Rat LD_{50} > 3,000 mg/kg(ChemIDplus)

Inhalation : Not classified (ATEmix > 13 mg/L / 4 hr)

- 1-methyl-2-pyrrolidone : Rat LC50 > 5.1 mg/L / 4 hr(OECD Guideline 403)
- Aluminium : Rat LC_{50} > 0.888 mg/L / 4 hr(OECD Guideline 403)
- Graphite : Rat LC50 > 2,000 mg/m^3 / 4 hr(OECD Guideline 403, GLP)
- Copper : Rat LC_{50} > 5.11 mg/L / 4 hr(OECD Guideline 436, GLP)
- Trade secret 1 : Rat LC_{50} > 17.6 mg/L / 4 hr(OECD Guideline 403, GLP)
- Trade secret 2 : Rat LC_0 = 730 mg/m^3 / 8 hr(male/female)(OECD Guideline 403)
- Trade secret 3 : Rat LC_{50} > 5.36 mg/L / 4 hr(male/female)(OECD Guideline 403, GLP)
- Carbon black : Rat LC_0 = 4.6 mg/m^3 / 4 hr(OECD Guideline 403, ECHA)

Skin corrosion/ irritation : Not classified

- Cobalt lithium manganese nickel oxide : the test material was not irritating.
- Aluminium : In the skin irritation test using rabbits, the test material was not irritating. (Read-across)(OECD Guideline 404)
- Graphite : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404, GLP)
- 1-methyl-2-pyrrolidone : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404)
- Copper : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404, GLP)
- Trade secret 1 : 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 rabbits, the test material was not classified. (OECD Guideline 404, GLP)
- Trade secret 3 : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404)
- Trade secret 4 : In the skin irritation test using human skin model, the test material was non-corrosive. (OECD Guideline 431, GLP)
- Trade secret 5 : In the skin irritation test using human skin model, the test material was corrosive. (EU Method B.40, GLP)
- Lithium borofluoride : In the skin irritation test using human skin model, the test material was corrosive (OECD Guideline 439 (In Vitro Skin Irritation: Reconstructed Human Epidermis Test Method))
- Trade secret 6 : In the skin irritation test using human skin model, the test material was not corrosive (OECD Guideline 431, GLP)
- Carbon black : In the skin irritation test using rabbits, the test material was not classified. (OECD Guideline 404)

Serious eye damage/ irritation : Not classified

- Cobalt lithium manganese nickel oxide : the test material was not irritating.
- Aluminium : In the eye irritation test using rabbits, the test material was not irritating. (Read-across)
- Graphite : In the eyes irritation test with rabbits, the test material was irritating. but it was fully reversible within 7 days (OECD Guideline 405, GLP)
- 1-methyl-2-pyrrolidone : In the eyes irritation test using rabbits, the test material was irritating. Moderate ocular effects observed, but Corneal and conjunctival effects were reversible within 14 days and 21 days, respectively. (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)
- Trade secret 1 : In the eye irritation test using rabbits, the test material was not irritating. (OECD Guideline 405, GLP)
- Trade secret 2 : In the eye irritation test using rabbits, the test material was mildly irritating. (OECD Guideline 405, GLP)
- Trade secret 3 : In the eye irritation test using rabbits, the test material was not irritating. (GLP)
- Trade secret 5 : In the eye irritation test using fertilised brown leghorn chicken eggs, the test material was severely irritating. (GLP)
- Lithium borofluoride In the eye irritation test, the test material was not irritating. (OECD Guideline 437)
- Trade secret 6 : In the eye irritation test, the test material was not irritating (OECD Guideline 437)
- Carbon black : In the eye irritation test using rabbits, the test material was not irritating. (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 sensitisation effects on the respiratory tract. In humans, no cases of allergies were reported to the responsible occupational physicians.

Skin sensitization : Not classified

- Cobalt lithium manganese nickel oxide : this material was not skin sensitizing. (Mouse)
- Aluminium : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing.
- Graphite : In the skin sensitization test using mice, the test material was not skin sensitizing. (OECD Guideline 429, GLP)
- 1-methyl-2-pyrrolidone : In the skin sensitization test using mice, the test material was not skin sensitizing. (OECD Guideline 429, GLP)
- Copper : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing. (OECD Guideline 406, GLP)
- Trade secret 1 : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing. (OECD Guideline 406, GLP)
- Trade secret 2 : In the skin sensitization test using guinea pigs, the test material was not classified. (OECD Guideline 406, GLP)
- Trade secret 3 : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing. (OECD Guideline 406, GLP)
- Trade secret 4 : In the skin sensitization test using mice, the test material was skin sensitization. (OECD Guideline 429, GLP)
- Trade secret 5 : In the skin sensitization test using mice, the test material was not skin sensitizing. (OECD Guideline 429, GLP)
- Lithium borofluoride : In the skin sensitization test, the test material was not skin sensitizing. (OECD Guideline 442C)
- Trade secret 6 : In the skin sensitization test, the test material was not skin sensitizing. (OECD Guideline 442C)
- Carbon black : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing. (OECD Guideline 406, GLP)

Carcinogenicity : Not classified

- Cobalt lithium manganese nickel oxide :

  IARC :

  Group 1 (Nickel compounds)

  Group 2B (Cobalt and cobalt compounds)

  ACGIH:

  A1 (Nickel insoluble inorganic compounds),

  A3 (Cobalt inorganic compounds)

  A4 (Nickel soluble inorganic compounds, Manganese inorganic compounds)

  NTP:

  K (Nickel compounds)

  R (Cobalt compounds)

  OSHA:

  Present (Nickel compounds, Cobalt compounds)
- Aluminium :

  ACGIH: A4 (Aluminum, Aluminum insoluble compounds)
- Carbon black :

  IARC : Group 2B

  ACGIH: A3

  OSHA: Present

Mutagenicity : Not classified

- Cobalt lithium manganese nickel oxide : Nagative : in vitro test ((Ames test, S. typhimurium, E. Coli)(Chromosome aberration test, human lymphocyte)
- Aluminium : Negative reactions were observed in both in vivo (Mammalian Erythrocyte Micronucleus Test(OECD Guideline 474, GLP)) and in vitro (Mammalian cell gene mutation test(OECD Guideline 476, GLP)).
- Graphite : : Negative reactions were observed in vitro (Bacterial Reverse Mutation Assay (OECD Guideline 471, GLP))
- 1-methyl-2-pyrrolidone : 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)).
- Copper : Negative reactions were observed in in vivo test(mammalian somatic cell study: cytogenicity/erythrocyte micronucleus(EU Method B.12, GLP)).
- Trade secret 1 : Negative reactions were observed in vitro (Mammalian Chromosome Aberration Test (OECD Guideline 473, GLP))
- Trade secret 2 : Negative reactions were observed in vitro (Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP)).
- Trade secret 3 : Negative reactions were observed in in vivo (Mammalian Spermatogonial Chromosome Aberration Test (OECD Guideline 483, GLP))
- Trade secret 4 : Positive reactions were observed in vitro (Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP)) and Negative reactions were observed in vivo (Mammalian Erythrocyte Micronucleus Test(OECD Guideline 474, GLP)).
- Trade secret 5 : 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)).
- Lithium borofluoride : Positive reactions were observed in vitro (Bacterial Reverse Mutation Assay (OECD Guideline 471, GLP))
- Trade secret 6 : : Negative reactions were observed in vitro (Bacterial Reverse Mutation Assay (OECD Guideline 471, GLP))
- 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 cells).

Reproductive toxicity : Not classified

- Aluminium : In the reproductive toxicity and developmental toxicity test using rats, adverse effects were not observed, respectively. (OECD Guideline 422, GLP)(OECD Guideline 414)
- Graphite : In the reproductive toxicity and developmental toxicity test using rats, adverse effects were not observed (OECD Guideline 422, GLP)
- 1-methyl-2-pyrrolidone : 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)).
- 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)
- Trade secret 1 : In the reproductive toxicity and developmental toxicity test using rats, adverse effects were not observed, respectively. (OECD Guideline 414)
- Trade secret 2 : 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)
- Trade secret 3 : 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)
- Trade secret 5 : In the reproductive toxicity and developmental toxicity test using rats, adverse effects were not observed, respectively. (OECD Guideline 416, GLP)(OECD Guideline 414)
- Carbon black : In the reproductive toxicity and developmental toxicity test using mice, adverse effects were not observed, respectively. (OECD Guideline 414, GLP)

Specific target organ toxicity (single exposure) : Not classified

- 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)
- Graphite : In the acute oral toxicity test using rats, adverse effects were not observed (OECD Guideline 423, GLP)
- 1-methyl-2-pyrrolidone : In the acute oral toxicity test with rats, ataxia and diuresis(4,150 mg/kg bw) were observed. (OECD Guideline 401)
- 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)
- Trade secret 1 : 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)
- Trade secret 2 : In the acute dermal/inhalation toxicity test using rats, adverse effects were not observed, respectively. (OECD Guideline 402, GLP)(OECD Guideline 403)
- Trade secret 3 : 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)
- Trade secret 5 : In the acute oral toxcity test with rats, lethargy, hunched posture, uncoordinated movements, piloerection were observed. (OECD Guideline 423, 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)

Specific target organ toxicity (repeat exposure) : Not classified

- Cobalt lithium manganese nickel oxide : In surviving animals in 50 mg / ㎥ (3 weeks recovery group), the minimum degradation / regeneration in lung was observed. NAOEC (no adverse effect observation) was not decided.(Rat, 6 hr/day, 2 times exposure, 28 days observation, 2, 10, 50mg / m3, inhalation test, short term - lung toxicity test)

- 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)"
- Graphite : : In the repeated oral toxicity test using rats, toxicity to organs was not observed. (OECD Guideline 422, GLP) In the repeated inhalation toxicity test using rats, increased frequency of fibrosis in the lungs at high concentrations (OECD Guideline 412, GLP)
- 1-methyl-2-pyrrolidone : In the repeated oral toxicity test in 90 days with rats, a specific target organ for compound-related adverse systemic toxicity was not identified. (OECD Guideline 408, GLP)
- 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)
- Trade secret 1 : In the repeated oral toxicity test using rats, toxicity to organs was not observed. (OECD Guideline 407, GLP)
- Trade secret 2 : In the repeated oral toxicity tests using rats, toxicity to organs was not observed. (OECD Guideline 452)
- Trade secret 3 : In the repeated oral toxicity tests using rats, toxicity to organs was not observed. (OECD Guideline 408, GLP)
- Carbon black : In the sub-chronic inhalation toxicity test using rats, there was clear evidence of inflammation and some alveolar epithelial cell 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.

Aspiration Hazard : Not available

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 pre cautions 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.

A. Ecological toxicity

- Acute toxicity : Not classified (L(E)C_{50} > 0.6 mg/L)

Fish :

- Aluminium : 96hr-LC_{50}(*Pimephales promelas*) = 1.16 mg/L (GLP)
- Graphite : 96hr-LC_{50}(*Danio rerio*) > 100 mg/L (OECD Guideline 203, GLP)
- 1-methyl-2-pyrrolidone : 96hr-LC_{50}(*Oncorhynchus mykiss*) > 500 mg/L (OBBA-bulletin No.
- Copper : 96hr-LC_{50}(*Oncorhynchus mykiss*) = 0.164 mg/L
- Trade secret 1 : 96hr-LC_{50}(*Oncorhynchus mykiss*) > 100 mg/L (OECD Guideline 203, GLP)
- Trade secret 2 : 96hr-LC_{50}(*Oncorhynchus mykiss*) > 100 mg/L (OECD Guideline 203, GLP)
- Trade secret 3 : 96hr-LC_{50}(*(Danio rerio*) ≥ 100 mg/L (OECD Guideline 203, GLP)
- Trade secret 5 : 96hr-LC_{50}(*Oncorhynchus mykiss*) = 51 mg/L

- Carbon black : 96hr-LC_0(*Danio rerio*) = 1,000 mg/L (OECD Guideline 203, GLP, ECHA)

crustacean :

- Aluminium : 48hr-LC_{50}(*Ceriodaphnia dubia*) = 0.72 mg/L (GLP)
- Graphite : 48hr-EC_{50}(*Daphnia magna*) > 100 mg/L (OECD Guideline 202, GLP)
- Copper : 48hr-LC_{50}(*Ceriodaphnia dubia*) = 0.014 mg/L
- Trade secret 1 : 48hr-EC_{50}(*Daphnia magna*) > 100 mg/L (OECD Guideline 202, GLP)
- Trade secret 2 : 48hr-EC_{50}(*Ceriodaphnia dubia*) = 5,900 mg/L
- Trade secret 3 : 48hr-EC_{50}(*Daphnia magna*) > 100 mg/L (OECD Guideline 202, GLP)
- Trade secret 4 : 48hr-LC50 = 8.4 mg/L (OECD Guideline 202, GLP)
- Trade secret 5 : 48hr-LC_{50}(*Daphnia magna*) > 100 mg/L (OECD Guideline 202, GLP)
- Lithium borofluoride : 48hr-EC_{50}(*Daphnia magna*) = 33.53 mg/L (OECD Guideline 202, GLP)
- Trade secret 6 : 48hr-EC_{50}(*Daphnia magna*) > 24.2 mg/L (OECD Guideline 202, GLP)
- Carbon black : 24hr-EC_{50}(*Daphnia magna*) > 5,600 mg/L (OECD Guideline 202, GLP, ECHA)

Algae :

- Aluminium : 72hr-EC_{50}(*Pseudokirchneriella subcapitata*) = 0.2 mg/L (OECD Guideline 201, GLP)
- Graphite : 72hr-EC_{50}(*Pseudokirchneriella subcapitata*) > 100 mg/L (OECD Guideline 201, GLP)
- 1-methyl-2-pyrrolidone : 72hr-EC_{50}(*Desmodesmus subspicatus*) = 600.5 mg/L (DIN 38412 Part9)
- Copper : 96hr-EC_{50}(*Chlamydomonas reinhardtii*) = 0.047 mg/L
- Trade secret 1 : 72hr-EC_{50}(*Desmodesmus subspicatus*) > 62 mg/L (OECD Guideline 201, GLP)
- Trade secret 2 : 72hr-EC_{50}(*Pseudokirchneriella subcapitata*) > 100 mg/L (OECD Guideline 201,GLP)
- Trade secret 3 : 72hr-EC_{50}(*Pseudokirchneriella subcapitata*) > 100 mg/L (OECD Guideline 201, GLP)
- Trade secret 4 : 72hr-EC50 = 32 mg/L
- Trade secret 5 : 96hr-EC_{50}(*Pseudokirchneriella subcapitata*) > 100 mg/L (OECD Guideline 201, GLP)
- Lithium borofluoride : 72hr-EC_{50}(*Freshwater Alga and Cyanobacteria*) = 48.32 mg/L (OECD Guideline 201, GLP)
- Trade secret 6 : 72hr-EC_{50}(*Freshwater Alga and Cyanobacteria*) > 28.9 mg/L (OECD Guideline 201, GLP)
- Carbon black : 72hr-EC_{50}(*Desmodesmus subspicatus*) > 10,000 mg/L (OECD Guideline 201, GLP), ECHA)

- Chronic toxicity : Not classified

Fish :

- Aluminium : 33day-NOEC(*Danio rerio*) = 0.0715 mg/L (OECD Guideline 210, GLP)
- Copper : 30day-NOEC(*Perca fluviatilis*) = 0.188 mg/L (OECD Guideline 204)
- Trade secret 5 : 22day-NOEC(*Pimephales promelas*) = 0.2 mg/L (EPA 540/86, GLP)

crustacean :

- Aluminium : 28day-NOEC(*Hyalella azteca*) = 0.0531 mg/L (GLP)
- 1-methyl-2-pyrrolidone : 21day-NOEC = 12.5 mg/L (OECD Guideline 211, GLP)

- Copper : 14day-NOEC(*Penaeus mergulensis and Penaeus monodon (prawns*) = 0.033 mg/L
- Trade secret 3 : 21day-NOEC(*Daphnia magna*) = 25 mg/L (OECD Guideline 211, GLP)
- Trade secret 5 : 7day-NOEC(*Ceriodaphnia dubia*) = 2.55 mg/L (EPA/600/4-91/002)

Algae :

- Graphite : 72hr-NOEC(*Pseudokirchneriella subcapitata*) ≥ 100 mg/L (OECD Guideline 201, GLP)
- 1-methyl-2-pyrrolidone : 72hr-EC_{50}(*Desmodesmus subspicatus*) = 672.8 mg/L (DIN 38412 Part9)
- Copper : 19day-NOEC(*giant kelp Macrocystis pyrifera*) = 0.0102 mg/L
- Trade secret 1 : 72hr-NOEC(*Desmodesmus subspicatus*) = 62 mg/L (OECD Guideline 201, GLP)
- Trade secret 2 : 72hr-NOEC(*Pseudokirchneriella subcapitata*) = 100 mg/L (OECD Guideline 201,GLP)
- Trade secret 5 : 96hr-NOEC(*Pseudokirchneriella subcapitata*) = 22 mg/L (OECD Guideline 201, GLP)
- Carbon black : 72hr-NOEC(*Desmodesmus subspicatus*) > 10,000 mg/L (OECD Guideline 201, GLP, ECHA)

B. Persistence and degradability

Persistence :

- 1-methyl-2-pyrrolidone : Low persistency (log Kow is less than 4 estimated.) (log Kow = -0.46)
- Trade secret 1 : Low persistency (log K_{ow} is less than 4 estimated.) (log K_{ow} = 0.972) (40 °C, EU Method A.8, GLP)
- Trade secret 2 : Low persistency (log K_{ow} is less than 4 estimated.) (log K_{ow} = 0.11) (20 °C, 5.33 < pH < 5.79)
- Trade secret 3 : Low persistency (log K_{ow} is less than 4 estimated.) (log K_{ow} = 0.354) (20°C, 6.5 < pH < 7.5)
- Trade secret 4 : Low persistency (log Kow is less than 4 estimated.) (Log Kow = -0.435)
- Trade secret 5 : Hydrolysis readily in contact with water. According to this it was not possible to determine the partition coefficient. (OECD Guideline 107, GLP)

Degradability :

- Cobalt lithium manganese nickel oxide : Because it is an inorganic substance, it is not decomposed.

C. Bioaccumulative potential

Bioaccumulation :

- 1-methyl-2-pyrrolidone : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 3.162) (estimated)
- Trade secret 3 : Bioaccumulation is expected to be low according to the BCF < 500 (BCF < 3.2)
- Trade secret 5 : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 53~58)

Biodegradation :

- 1-methyl-2-pyrrolidone : As well-biodegraded, it is expected to have low accumulation potential in living organisms(73% biodegradation was observed after 28 days) (OECD Guideline 301C)
- Trade secret 1 : 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 well-biodegraded, it is expected to have low accumulation potential in living organisms(86% biodegradation was observed after 29 days) (OECD Guideline 301B)
- Trade secret 3 : As well-biodegraded, it is expected to have low accumulation potential in living organisms(86% biodegradation was observed after 28 days) (OECD Guideline 301C)
- Trade secret 4 : As not well-biodegraded, it is expected to have high accumulation potential in living organisms (= 38% biodegradation was observed after 21 days) (OECD Guideline 301 D, GLP)

D. Mobility in soil :
- 1-methyl-2-pyrrolidone : No potency of mobility to soil. (Koc = 4.65) (estimated)
- Trade secret 1 : No potency of mobility to soil. (K_{oc} = 1.58) (OECD Guideline 121, GLP)
- Trade secret 2 : No potency of mobility to soil. (K_{oc} = 11.9)
- Trade secret 3 : No potency of mobility to soil. (K_{oc} = 2.9 ~ 6.65) (25 °C)
- Trade secret 4 : Low potency of mobility to soil. (K_{oc} = 5.117)

E. Other hazardous effect : Not available

F. Hazardous to the ozone layer : Not applicable

13. Disposal considerations

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

B. Disposal precaution :
- Consider the required attentions in accordance with waste treatment management regulation.

14. Transport information

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

A. UN Number : 3480

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

C. Transport Hazard class : 9

D. Packing group : II

E. Special provisions : 188
F. Packing instructions : P903
G. Environmental hazards : No
H. Special precautions
in case of fire : F-A
in case of leakage : S-I
I. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not Available
J. IATA Transport : PI 965-Section IA
K. Package labels :

L. Additional transport information in U.S.A
US Hazardous Materials Regulations 49 CFR(Code of Federal Regulations) :
- Sections 172.101 (Lithium ion batteries including lithium ion polymer batteries ; UN3480)
- Sections 172.102 (Special provisions 388, 422, A54, A100)
- Sections 173.185 (Lithium batteries and cells)

15. Regulatory information

A. U.S.A Regulatory information
U.S.A Inventory (TSCA)
- Cobalt lithium manganese nickel oxide : Present [PMN; S; 5E] (ACTIVE)
- Graphite : Present (ACTIVE)
- Aluminium : Present (ACTIVE)
- 1-methyl-2-pyrrolidone : Present (ACTIVE)
- Copper : Present (ACTIVE)
- Trade secret 1: Present (ACTIVE)
- Trade secret 2 : Present (ACTIVE)
- Trade secret 3 : Present (ACTIVE)
- Trade secret 4 : Present (ACTIVE)
- Trade secret 5 : Present [PMN] (ACTIVE)
- Trade secret 6 : Present [PMN; S] (ACTIVE)
- Lithium borofluoride : Present (ACTIVE)
- Carbon black : Present (ACTIVE)

U.S.A management information (OSHA Regulation) : Not regulated
U.S.A management information (CERCLA Regulation) :
- Cobalt lithium manganese nickel oxide : Indicates that no RQ is assigned to this generic or broad class, although the class is a CERCLA hazardous substance. (Nickel Compounds, Cobalt Compounds)

- Copper : 5000lb

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) :

- Cobalt lithium manganese nickel oxide : Regulated (Nickel, Cobalt, Manganese compounds)
- Aluminium : Regulated (fume or dust)
- Copper : Regulated

Substance of Rotterdam Convention : Not regulated

Substance of Stockholm Convention : Not regulated

Substance of Montreal Protocol : Not regulated

16. Other information

A. Information source and references :

UN Recommendations on the transport of dangerous goods 17th
Emergency Response Guidebook 2008;
http://phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/erg2008_eng.pdf
EU CLP; https://echa.europa.eu/information-on-chemicals/cl-inventory-database
REACH information on registered substances; https://echa.europa.eu/information-on-chemicals/registered-substances
U.S. National library of Medicine (NLM) Hazardous Substances Data Bank(HSDB);
http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB
OECD SIDS; http://webnet.oecd.org/hpv/ui/Search.aspx
ECOTOX; http://cfpub.epa.gov/ecotox/
EPISUITE v4.11; https://www.epa.gov/tsca-screening-tools/download-epi-suitetm-estimation-program-interface-v411
Chemicalbook; http://www.chemicalbook.com/ProductIndex_EN.aspx
LookChem; http://www.lookchem.com/
Chemblink;http://www.chemblink.com/
SIGMA-ALDRICH; http://www.sigmaaldrich.com/united-states.html
Chemspider; http://www.chemspider.com/
IARC Monographs on the Evaluation of Carcinogenic Risks to Humans;
http://monographs.iarc.fr
National Toxicology Program; http://ntp.niehs.nih.gov/results/dbsearch/
TOMES-LOLI®; http://www.rightanswerknowledge.com/loginRA.asp
American Conference of Governmental Industrial Hygienists TLVs and BEIs.
NIOSH Pocket Guide; http://www.cdc.gov/niosh/npg/npgdcas.html

B. Issuing date : 21. Feb, 2020

C. Revision number and date

revision number : Rev.(01)

date of the latest revision : 22. Oct, 2020

D. Others :

• The content is based on the latest information and knowledge that we currently possess.

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