



## Safety Data Sheet

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

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

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

#### 1.1 Product identifier

**Substance name :** Lithium-ion batteries

**Synonyms :**

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

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

**Relevant identified uses :** Lithium-ion batteries

**Uses advised against :** Use for recommended use only

**Further Information :** Not available

#### 1.3 Details of the supplier of the safety data sheet

**Supplier :** SAMSUNG SDI Co., Ltd.

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

**Country ID/Postcode/Place :**

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

**Responsible Department:** Quality team

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

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

#### 1.4 Emergency Telephone

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

**Opening hours :** Not available

**Other comments :** Not available

#### 1.5 Further Information

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

Anode (negative electrode): based on intercalation graphite

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

#### **Remark:**

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



## Section II – HAZARDS IDENTIFICATION

※ 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.

### 2.1 Classification of the substance or mixture

#### 2.1.1 Classification according to Regulation (EC) No. 1272/2008 [CLP] and OSHA 29 CFR 1910.12

00 : Not classified

#### 2.1.2 Additional information:

##### Classification of the substance or mixture.

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

##### **Hazardous Materials Information Label (HMIS)**

Health: Not available

Flammability: Not available

Physical Hazard: Not available

##### **NFPA Hazard Ratings**

Health: Not available

Flammability: Not available

Reactivity: Not available

### 2.2 Label elements

**Hazard pictograms :** Not applicable

**Signal word :** Not applicable

**Hazard statement :** Not applicable

**Precautionary statements:** Not applicable

**Supplemental Hazard information (EU) :** Not applicable

### 2.3 Other hazards :

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

**Primary Routes(s) of Exposure:** These chemicals are contained in a sealed enclosure. Risk of exposure occurs only if the cell or pack is mechanically, thermally, electrically or physically abused to the point of compromising the enclosure.

If this occurs, exposure to the electrolyte solution contained within can occur by inhalation, ingestion, eye contact and skin contact.



**Potential Health Effect(s):**

**Acute (short term):** see Section 8 for exposure controls.

In the event that this cell or pack has been ruptured, the electrolyte solution contained within the cell would be corrosive and can cause burns to skin and eyes.

**Inhalation:** Inhalation of materials from a sealed cell is not an expected route of exposure. Vapors or mists from a ruptured cell may cause respiratory irritation.

**Ingestion:** Swallowing of materials from a sealed cell is not an expected route of exposure.

Swallowing the contents of an open cell can cause serious chemical burns to mouth, esophagus, and gastrointestinal tract.

**Skin:** Contact between the cell and skin will not cause any harm. Skin contact with the contents of an open cell can cause severe irritation or burns to the skin.

**Eye:** Contact between the cell and the eye will not cause any harm. Eye contact with the contents of an open cell can cause severe irritation or burns to the eye.

**CHRONIC (long term):** see Section 11 for additional toxicological data.

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

**Potential Environmental Effects:** Not Available.

## Section III – COMPOSITION/INFORMATION ON INGREDIENTS

### 3.1 Mixture

CAS No.	EC No.	REACH Registration No.	%[weight]	Name	Common Name (Synonyms)	Classification according to Regulation(EC) No 1278/2008(CLP)
12016-80-7	234-614-7	-	15~25	cobalt hydroxide oxide	Not available	Not classified
7782-42-5	231-955-3	-	10~20	Graphite	Not available	Not classified
7429-90-5	231-072-3	-	10~20	Aluminium	Not available	Pyr. Sol. 1, H250 Water-react. 2, H261
554-13-2	209-062-5	-	10~20	lithium carbonate	Not available	Not classified
7440-50-8	231-159-6	-	1~10	Copper	Not available	Not classified
623-53-0	Not available	-	1~5	Ethyl methyl carbonate	Not available	Not classified
1308-06-1	215-157-2	-	1~5	tricobalt tetraoxide	Not available	Not classified
96-49-1	202-510-0	-	1~5	1,3-Dioxolan-2-one	Not available	Not classified
9002-88-4	Not available	-	1~5	Polyethylene	Not available	Not classified

105-58-8	203-311-1	-	1~5	Carbonic acid diethyl ester	Not available	Not classified
21324-40-3	244-334-7	-	1~5	lithium hexafluorophosphate(1-)	Not available	Not classified
110-61-2	203-783-9	-	0.1~1	Butanedinitrile	Not available	Not classified
1333-86-4	215-609-9	-	0.1~1	Carbon black	Not available	Not classified
7439-89-6	231-096-4	-	0.1~1	Iron	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
7439-96-5	231-105-1	-	0.1~1	Manganese	Not available	Not classified
1120-71-4	214-317-9	-	0.1~1	1,3-propanesultone	Not available	Acute Tox. 4 *, H302 Acute Tox. 4 *, H312 Carc. 1B, H350

#### **Further Information**

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

## **Section IV – FIRST-AID MEASURES**

### **4.1 Description of first aid measures**

#### **Following eye contact :**

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

#### **Following skin contact :**

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

#### **Following inhalation :**

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

#### **Following ingestion :**

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

#### **Further Information :**



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

#### **4.2 Most important symptoms and effects, both acute and delayed**

**Acute effects** : Not available

**Delayed effects** : Not available

#### **4.3 Indication of immediate medical attention and special treatment needed**

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

## **Section V – FIRE-FIGHTING MEASURES**

### **5.1 Extinguishing media**

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

### **5.2 Special hazards arising from the substance or mixture**

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

### **5.3 Advice for firefighters**

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

## **Section VI – ACCIDENTAL RELEASE MEASURES**

### **6.1 Personal precautions, protective equipment and emergency procedures**

#### **For non-emergency personnel**

**Protective equipment** : Use personal protective equipment, see Section 8

**Emergency procedures** :

- In case of cell damage, possible release of dangerous substances and a flammable gas mixture.
- Eliminate all ignition sources.
- Please note that materials and conditions to avoid.



- Battery may emit electrolyte if charging or discharging rates exceed manufacturer's recommendations or if pack has been breached.
- Move battery to well ventilated area to prevent gas accumulation.

**For emergency responders**

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

**6.2 Environmental precautions :**

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

**6.3 Methods and material for containment and cleaning up**

**For containment :** Not available

**For cleaning up :**

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

**Other information:** Not available

**6.4 Reference to other sections**

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

## Section VII – HANDLING AND STORAGE

**7.1 Precautions for safe handling**

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

**7.2 Conditions for safe storage, including any incompatibilities**

**Technical measures and storage conditions :** Not available

**Packaging materials :** Not available

**Requirements for storage rooms and vessels :**

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

**7.3 Specific end use(s)**

**Recommendations :** Not available

**Industrial sector specific solutions :** Not available



## Section VIII – EXPOSURE CONTROLS / PERSONAL PROTECTION

### 8.1 Control parameters

#### Occupational Exposure limits

Name	ACGIH regulation	Biological exposure index	OSHA regulation	NIOSH regulation	EU regulation
cobalt hydroxide oxide	Not applicable	Not available	Not applicable	Not applicable	Not applicable
Cobalt, Co	TWA = 0.02 mg/m <sup>3</sup>	Not available	TWA = 0.1 mg/m <sup>3</sup>	TWA 0.05 mg/m <sup>3</sup>	Not applicable
Graphite	TWA = 2mg/m <sup>3</sup>	Not available	Not applicable	Not applicable	Not applicable
Aluminium	TWA = 1 mg/m <sup>3</sup> (respirable particulate matter)	Not available	TWA = 15 mg/m <sup>3</sup> (Aluminum Metal (as Al) Total dust) TWA = 5 mg/m <sup>3</sup> (Aluminum Metal (as Al) Respirable fraction)	TWA = 1 mg/m <sup>3</sup> (Aluminum Metal (as Al),Respirable fraction)	Not applicable
lithium carbonate	Not applicable	Not available	Not applicable	Not applicable	Not applicable
Copper	TWA = 0.2 mg/m <sup>3</sup> (fume)	Not available	Not applicable	Not applicable	Not applicable
Ethyl methyl carbonate	Not applicable	Not available	Not applicable	Not applicable	Not applicable
tricobalt tetraoxide	TWA = 0.2 mg/m <sup>3</sup> (Cobalt and cobalt compounds,CAS. no7440-48-4)	Not available	TWA = 0.1 mg/m <sup>3</sup> (Cobalt metal, dust, and fume (as Co),CAS.no7440-48-4)	TWA = 0.05 mg/m <sup>3</sup> (Cobalt metal, dust, and fume (as Co),CAS.no7440-48-4)	Not applicable
1,3-Dioxolan-2-one	Not applicable	Not available	Not applicable	Not applicable	Not applicable
Polyethylene	Not applicable	Not available	Not applicable	Not applicable	Not applicable
Carbonic acid diethyl ester	Not applicable	Not available	Not applicable	Not applicable	Not applicable
lithium hexafluorophosphate(1-)	Not applicable	Not available	Not applicable	Not applicable	Not applicable



Butanedinitrile	Not applicable	Not available	Not applicable	Not applicable	Not applicable
Carbon black	TWA = 3mg/m <sup>3</sup> (inhalable particulate matter)	Not available	TWA = 3.5 mg/m <sup>3</sup>	TWA = 3.5 mg/m <sup>3</sup> Ca TWA = 0.1 mg PAHs/m <sup>3</sup> [Carbon black in presence of polycyclic aromatic hydrocarbons (PAHs)]	Not applicable
Iron	Not applicable	Not available	Not applicable	Not applicable	Not applicable
Nickel	TWA = 1.5 mg/m <sup>3</sup> (inhalable particulate matter)	Not available	TWA = 1 mg/m <sup>3</sup> (metal and insoluble compounds (as Ni)) TWA = 1 mg/m <sup>3</sup> (soluble compounds (as Ni))	Ca TWA = 0.015 mg/m <sup>3</sup> (metal and insoluble compounds (as Ni)) Ca TWA = 0.015 mg/m <sup>3</sup> (soluble compounds (as Ni))	Not applicable
Manganese	TWA = 0.02 mg/m <sup>3</sup> (respirable particulate matter); TWA = 0.1 mg/m <sup>3</sup> (inhalable particulate matter)	Not available	Celling = 5mg/m <sup>3</sup>	1 mg/m <sup>3</sup> (ST) 3 mg/m <sup>3</sup> (Manganese compounds (as Mn), Manganese fume (as Mn))	TWA = 0.2 mg/m <sup>3</sup> (inhalable fraction)
1,3-propanesultone	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 IX – PHYSICAL AND CHEMICAL PROPERTIES

### 9.1 Information on basic physical and chemical properties

#### Appearance

**Description :** Solid

**Color :** Not available



**Odor** : Odorless

**Odor threshold** : Not available

**pH** : Not available

**Melting point/freezing point** : Not available

**Initial boiling point and boiling range** : Not available

**Flash point** : Not available

**Evaporation rate** : Not available

**Flammability (solid, gas)** : Not available

**Upper/lower flammability or explosive limits** : Not available

**Vapor pressure** : Not available

**Solubility (ies)** : insoluble.

**Vapor density** : Not available

**Relative density** : Not available

**Partition coefficient: n-octanol/water** : Not available

**Auto ignition temperature** : Not available

**Decomposition temperature** : Not available

**Viscosity** : Not available

**Explosive properties** : Not available

**Oxidizing properties** : Not available

**Molecular weight** : Not available

## 9.2 Other information

Not available

## Section X – STABILITY AND REACTIVITY

### 10.1 Reactivity

- Stable at ambient temperature.

### 10.2 Chemical stability

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

### 10.3 Possibility of hazardous reactions

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

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

### 11.1 Information on toxicological effects

#### Acute toxicity

**Oral** : Not classified (ATEmix = 1948 mg/kg bw)

- Cobalt hydroxide oxide : Rat LD<sub>50</sub> > 5,000 mg/kg (OECD Guideline 425, GLP)
- Graphite : Rat LD<sub>50</sub> > 2,000 mg/kg (female)(OECD Guideline 401)
- Aluminum : Rat LD<sub>50</sub> > 15,900 mg/kg (OECD TG 401)(Fumed alumina; read across)
- Lithium carbonate;Lithane : Rat LD<sub>50</sub> = 525 mg/kg
- Copper : Rat LD<sub>50</sub> > 2,500 mg/kg (Cupric oxide; read across)(OECD TG 423, GLP)
- Tricobalt tetraoxide : Rat LD<sub>50</sub> > 5,000 mg/kg (OECD TG 401, GLP)
- 1,3-Dioxolan-2-one : Rat LD<sub>50</sub> = 10,400 mg/kg (male) (OECD Guideline 401)
- Polyethylene : Rat LD<sub>50</sub> > 2,000 mg/kg
- Carbonic acid diethyl ester : Rat LD<sub>50</sub> > 4,876 mg/kg
- Lithium hexafluorophosphate(1-) : Rat LD<sub>50</sub> = 50 ~ 300 mg/kg (Female)(OECD Guideline 423, GLP)
- Butanedinitrile : Rat LD<sub>50</sub> = 300 ~ 2,000 mg/kg (female) (OECD Guideline 423, GLP)
- Carbon black : Rat LD<sub>50</sub> > 8,000 mg/kg (male/female) (OECD Guideline 401)
- Fe : Rat LD<sub>50</sub> = 98,600 mg/kg (Reduced iron, OECD TG 401)



- Nickel; Raney nickel : Rat LD<sub>50</sub> > 9,000 mg/kg (male/female) (OECD Guideline 401, GLP)
- Manganese : Rat LD<sub>50</sub> > 2,000 mg/kg (OECD TG 420, GLP)
- 1,3-propanesultone : Rat LD<sub>50</sub> > 2000 mg/kg (OECD Guideline 401, GLP)

**Dermal** : Not classified (ATEmix = 299192 mg/kg bw)

- Cobalt hydroxide oxide : Rat LD<sub>50</sub> > 2,000 mg/kg (OECD Guideline 402, GLP)
- Lithium carbonate;Lithane : Rabbit LD<sub>50</sub> > 3,000 mg/kg (male/female) (OECD Guideline 402)
- Copper : Rat LD<sub>50</sub> > 2,000 mg/kg (OECD TG 402, GLP)
- Tricobalt tetraoxide : Rat LD<sub>50</sub> > 2,000 mg/kg (OECD TG 402, GLP)
- 1,3-Dioxolan-2-one : Rat LD<sub>50</sub> > 2,000 mg/kg (male/female) (OECD Guideline 402)
- Butanedinitrile : Rat LD<sub>50</sub> > 2,000 mg/kg (male/female) (OECD Guideline 402, GLP)
- Carbon black : Rabbit LD<sub>50</sub> > 3,000 mg/kg
- 1,3-propanesultone : Guinea pig LD<sub>50</sub> = 700~1400 mg/kg

**Inhalation** Not classified (ATEmix = 262.68 mg/kg bw)

- Graphite : Rat LD<sub>50</sub> > 2 mg/L/4hr (male/female) (OECD Guideline 403)
- Aluminum : Rat LC<sub>50</sub> > 0.888 mg/L/4hr (analytical) (OECD TG 403)
- Lithium carbonate;Lithane : Rat LC<sub>50</sub> > 2 mg/L/4hr (male/female) (OECD Guideline 403)
- Tricobalt tetraoxide : Rat LC<sub>50</sub> > 5.06 mg/L/4hr (OECD TG 436, GLP)
- 1,3-Dioxolan-2-one : Rat LC<sub>0</sub> = 730 mg/m<sup>3</sup>/8hr
- Carbonic acid diethyl ester : Rat LC<sub>50</sub> > 1.268 mg/L/7hr (No signs for acute toxicity via the inhalation route were found up to concentrations of 1268 mg/m<sup>3</sup>)
- Butanedinitrile : Rat LC<sub>50</sub> ≥ 2.67 mg/L/4hr (male/female) (OECD Guideline 403)
- Carbon black : Rat LD<sub>50</sub> > 4.6 mg/m<sup>3</sup>/4hr
- Fe : Rat LC<sub>50</sub> > 100 mg/m<sup>3</sup>/6hr
- Manganese : Rat LC<sub>50</sub> > 5.14 mg/L/4hr (OECD TG 403, GLP)
- 1,3-propanesultone : Rat LC<sub>0</sub> > 1.3 mg/L/ 6hr (OECD Guideline 403)

**Skin corrosion/ irritation** : Not classified

- Cobalt hydroxide oxide : In the in vitro skin irritation test, the test material was not irritating.(OECD Guideline 431, GLP)
- Graphite : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404, GLP)
- Aluminum : Aluminium oxide caused slight erythema in 2/12 rabbits. The observed effects do not lead to a classification. Aluminium oxide is, therefore, not considered to be a primary skin irritant.(OECD TG 404)(Read across; aluminium oxide)
- Lithium carbonate;Lithane : In the skin irritation test using rabbits, the test material was not irritating. (OECD Guideline 404, GLP)
- Copper : In test on skin irritation with rabbits, skin irritations were not observed. (OECD TG 404, GLP)
- Ethyl methyl carbonate : In the skin irritation test using rabbits, the test material was not irritating. (GLP)
- Tricobalt tetraoxide : In a test with rabbits, this substance was not a skin irritating. (OECD TG 439, GLP)
- 1,3-Dioxolan-2-one : In the skin irritation test using rabbits, the test material was not classified. (OECD Guideline 404, GLP)
- 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.
- Carbonic acid diethyl ester : strong irritant.
- Lithium hexafluorophosphate(1-) : In the skin irritation test using human, the test material was corrosive. (EU Method B.40, GLP)
- Butanedinitrile : In the skin irritation test using rabbits, the test material was not irritating. (OECD



Guideline 404)

- Carbon black : In test on skin irritation with rabbits, skin irritations were not observed. (OECD Guideline 404)

- Fe : In test on skin irritation with rabbits, skin irritations were not observed.(Read across; Fe<sub>3</sub>O<sub>4</sub>)(OECD TG 404, GLP)

- Nickel; Raney nickel : Industrial nickel dust causes nickel dermatitis.

- Manganese : In test on skin irritation with rabbits, skin irritations were not observed.(OECD TG 404, GLP)

- 1,3-propanesultone : In the skin irritation test using guinea pigs, the test material was corrosive. (TOXICITY STUDIES OF 1,2-OXATHIOLANE,2,2-DIOXIDE WITH COVER LETTER DATED 09/01/92)

**Serious eye damage/ irritation** : Not classified

- Cobalt hydroxide oxide : In the eye irritation test using rabbit, the test material was not irritating.(OECD Guideline 405)

- Graphite : In the eye irritation test using rabbit, the test material was not irritating. (OECD Guideline 405, GLP)

- Aluminum : An eye irritation study of the aluminium oxide was performed in rabbits. No eye irritation/corrosion effects were observed. (Read across; aluminium oxide)

- Lithium carbonate; Lithane : In the eye irritation test using rabbit, the test material was moderately irritating. (OECD Guideline 405, GLP)

- Copper : In test on skin irritation with rabbits, skin irritations were not observed. (OECD TG 405, GLP)

- Ethyl methyl carbonate : In the eye irritation test using rabbit, the test material was not irritating. (GLP)

- Tricobalt tetraoxide : The test item Tricobalt tetraoxide did not cause permeability of the cornea compared with the results of the negative control, but slight opacity effects. The calculated mean in vitro score was 10.39 and therefore, the test item was classified as mild eye irritant.(OECD TG 437, GLP)

- 1,3-Dioxolan-2-one : In the eye irritation test using rabbit, the test material was moderately irritating. (OECD Guideline 405, GLP)

- Polyethylene : Mild irritants were observed in eye irritation test with rabbits. (Score 11.7/110)

- Carbonic acid diethyl ester : strong irritant.

- Lithium hexafluorophosphate(1-) : In the eye irritation test using fertilised brown leghorn chicken eggs, the test material was severely irritating. (GLP)

- Butanedinitrile : In the eye irritation test using rabbit, the test material was not irritating. (OECD Guideline 405)

- Carbon black : In test on eyes irritation with rabbits, eyes irritations were not observed. (OECD Guideline 405)

- Fe : In test on eyes irritation with rabbits, eyes irritations were not observed.(Read across; Fe<sub>3</sub>O<sub>4</sub>)(OECD TG 405, GLP)

- Manganese : In test on eyes irritation with rabbits, eyes irritations were not observed.(OECD TG 405, GLP)

- 1,3-propanesultone : In the eye irritation test using rabbits, the test material was corrosive. (TOXICITY STUDIES OF 1,2-OXATHIOLANE,2,2-DIOXIDE WITH COVER LETTER DATED 09/01/92)

**Respiratory sensitization** : Not classified

- Aluminum : Al<sub>2</sub>O<sub>3</sub> 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(female), it did not induce respiratory sensitization.

**Skin sensitization** : Not classified



- Cobalt hydroxide oxide : In the skin sensitization test using mouse, this material was not skin sensitizing.(OECD Guideline 429, GLP)
- Graphite : In the skin sensitization test using mice, the test material was not skin sensitization. (OECD Guideline 429, GLP)
- Aluminum : In test with guinea pigs, it can be concluded that aluminium oxide has no sensitisation potential under the experimental conditions. (Read across; Aluminium oxide)
- Lithium carbonate; Lithane : In the skin sensitization test using guinea pig, this material was not skin sensitizing. (OECD Guideline 406, GLP)
- Copper : In maximization test on skin sensitization with guinea pig, skin sensitization was not observed. (OECD TG 406, GLP)
- Ethyl methyl carbonate : In the skin sensitization test using guinea pig, this material was not skin sensitizing. (OECD Guideline 406, GLP)
- Tricobalt tetraoxide : In a LLNA with guinea-pigs, this substance was not classified as skin sensitiser.(OECD TG 429, GLP)
- 1,3-Dioxolan-2-one : In the skin sensitization test using guinea pig, this material was not classified. (OECD Guideline 406, GLP)
- Polyethylene : No reactions were observed in skin sensitization test with guinea pigs.
- Carbonic acid diethyl ester : In local lymphnode assay with mice, diethyl carbonate was shown to have no sensitising potential.(OECD TG 429, GLP)
- Lithium hexafluorophosphate(1-) : In the skin sensitization test using mice, the test material was not skin sensitization. (OECD Guideline 429, GLP)
- Butanedinitrile : In the skin sensitization test using mice, the test material was not classified. (OECD Guideline 429, GLP)
- Carbon black : In skin sensitization test with guinea pig(female), it did not induce skin sensitization. (OECD Guideline 406, 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)
- Nickel; Raney nickel : Nickel hypersensitivity dermatitis may be initiated by contact with nickel on the skin.
- Manganese : In the test using mouse, the test substance was not considered to be a dermal sensitizer in mouse.(OECD TG 429, GLP)
- 1,3-propanesultone : In the skin sensitization test using guinea pigs, the test material was not skin sensitizing. (OECD Guideline 406)

**Carcinogenicity** : Not classified

**IARC**

- Cobalt and cobalt compounds : Group 2B
- Carbon black : Group 2B
- Polyethylene : Group 3
- Nickel : Group 2B
- 1,3-propanesultone : Group 2A

**NTP**

- Iron : Present
- Carbon black : Present
- Nickel : Present
- 1,3-propanesultone : Present

**OSHA**

- cobalt hydroxide oxide : Present
- Carbon black : Present
- Nickel : Present
- 1,3-propanesultone : Present

**ACGIH**



- Cobalt and cobalt compounds : A3
- Aluminum : A4
- Carbon black : A3
- Nickel : A5
- Manganese : A4
- 1,3-propanesultone : A3

**KOREA-ISHL**

- Cobalt and inorganic compounds : 2
- Carbon black : 2
- Nickel : 1A
- 1,3-propanesultone : 1B

**EU**

- Nickel : Carc. 2
- 1,3-propanesultone : Carc. 1B

Cobalt hydroxide oxide : Carcinogenicity studies using rats (male / female) revealed carcinogenic effects.(OECD Guideline 451, GLP)

Copper : EPA IRIS: D In carcinogenicity study with rat, tumor was not observed.

Tricobalt tetraoxide : Under the conditions of these 2-year inhalation studies, there was some evidence of carcinogenic activity of cobalt sulfate heptahydrate in male F344/N rats based on increased incidences of alveolar/bronchiolar neoplasms.(GLP)

Polyethylene : Fifty rats were implanted with polyethylene. In the polyethylene group, 23 developed tumors (two of these were unrelated to the implants).

Carbonic acid diethyl ester : In long-term oral toxicity with mice,the incidence of histological lesions, including tumours of the ovaries was not influenced by treatment with the test substance.

Carbon black : Most of the tumours were benign squamous cysts, but a high incidence of adenocarcinoma was also found in all groups. (OECD Guideline 451)

**Mutagenicity : Not classified**

- Cobalt hydroxide oxide : Negative reactions were observed in vitro Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP). Negative reactions were observed in vivo Mammalian Bone Marrow Chromosome Aberration Test(OECD Guideline 475).
- Graphite : Negative reactions were observed in vitro (Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP)).
- Aluminum : Negative reactions were observed in vitro (mammalian cell gene mutation assay with mouse lymphoma L5178Y cells(OECD TG 476, GLP)) and in vivo (micronucleus assay with rats (OECD TG 474, GLP)). (Aluminium hydroxide, aluminium chloride, aluminum oxide; read across)
- Lithium carbonate; Lithane : Negative reactions were observed in vitro (Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP)).
- 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)
- Ethyl methyl carbonate : Negative reactions were observed in vitro (Mammalian Chromosome Aberration Test(OECD Guideline 473, GLP)).
- Tricobalt tetraoxide : Negative reactions were observed in vitro mammalian cell gene mutation test(OECD TG 476), mammalian cell micronucleus test and in vivo mammalian chromosome aberration assay(OECD 475).
- 1,3-Dioxolan-2-one : Negative reactions were observed in vitro (mammalian cell gene mutation assay (OECD Guideline 476, GLP)).
- Polyethylene : Negative reactions were observed in Ames test using Salmonella typhimurium and Escherichia coli.





- Carbonic acid diethyl ester : In vitro mammalian cell micronucleus test, positive reaction was observed. Diethyl carbonate showed clear evidence of genotoxic activity. (OECD TG 487, GLP) But, the substance is not classified as mutagenicity because there are no data in vivo genetic toxicity test.
- 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)).
- Butanedinitrile : Negative reactions were observed in both in vivo (Mammalian Erythrocyte Micronucleus test(OECD Guideline 474, GLP)) and in vitro (Bacterial Reverse Mutation Assay(OECD Guideline 471, GLP)).
- Carbon black : Negative reactions were observed in both in vitro(Bacterial Reverse Mutation Assay test(OECD Guideline 471, GLP))and in vivo(DNA damage and/or repair test).
- Fe : In mammalian cell gene mutation assay electrolytic iron, positive carbonyl iron exhibited a cytotoxic and mutagenic response (OECD TG 476)
- Manganese : In the mammalian cell gene mutation assay, the result of the assay was negative. (Read across; Manganese chloride)(OECD TG 476, GLP)
- 1,3-propanesultone : Positive reactions were observed in in vivo test (Mammalian Erythrocyte Micronucleus Test(OECD Guideline 474, GLP))

**Reproductive toxicity : Not classified**

- Cobalt hydroxide oxide : In the reproduction toxicity test using rat, no effects were observed.(OECD Guideline 408, 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)
- Copper : In reproductive toxicity with rats, there were no effects considered (up to 1500 ppm). (OECD TG 416, GLP)
- Tricobalt tetraoxide : No effect on cultured embryos derived from chronically treated male rats.
- Carbonic acid diethyl ester : In multigeneration study with rats, there were no indications of diethyl carbonate having an organotropic effect.
- 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 Guideline 414)

**Specific target organ toxicity (single exposure) : Not classified**

- 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)
- Copper : All animals showed expected gains in bodyweight over the study period and there were no abnormalities noted at necropsy. (OECD TG 423, GLP)
- Tricobalt tetraoxide : No clinical signs were observed during the study with rats.(OECD TG 402, GLP)
- Polyethylene : No test substance-related toxic effects were observed in an acute oral toxicity study with rats.
- Carbonic acid diethyl ester : In acute oral toxicity test with rats, no symptoms developed.
- 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.
- Fe : If inhaled, iron is a local irritant to the lung and gastrointestinal tract.





- Nickel; Raney nickel : In the acute oral toxicity using rat, there were no effects on clinical signs, systemic toxicity.(OECD Guideline 401, GLP)
- Manganese : In the acute oral toxicity using rat, there were no effects on clinical signs, systemic toxicity.(OECD TG 420, GLP)
- 1,3-propanesultone : In the acute oral toxicity test with rats, during days 4 and 13, dehydration, decreased respiratory rate, gasping, laboured and noisy respiration were observed. (OECD Guideline 401, GLP)

**Specific target organ toxicity (repeat exposure) : Not classified**

- Cobalt hydroxide oxide : Under the conditions of the 2-year inhalation study, there was some evidence of carcinogenic activity of cobalt sulfate heptahydrate in male F344/N rats. Increased alveolar / bronchial neoplasm and pheochromocytoma of the adrenal gland, inflammatory, fibrous, and proliferative lesions appear in the respiratory tract.
- Aluminum : On occasion workers chronically exposed to aluminum-containing dusts or fumes have developed severe pulmonary reactions including fibrosis, emphysema and pneumothorax.
- 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. Ophthalmoscopic 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)
- Tricobalt tetraoxide : Repeat exposure to cobalt sulfate heptahydrate caused a spectrum of inflammatory, fibrotic, and proliferative lesions in the respiratory tract of male and female rats.(GLP)
- Polyethylene : No significant adverse effects were observed in subchronic (90-day) oral toxicity study with rats and dogs.
- Carbonic acid diethyl ester : In repeated dose 83-weeks oral toxicity test with mice, a final conclusion about the effect of diethyl carbonate on the generation of histological lesions and tumours can not be drawn from the given study results.
- 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)
- 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.
- 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)
- 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 XII – ECOLOGICAL INFORMATION

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



## 12.1. Ecological toxicity

- Acute toxicity : Not classified (ATEmix = 0.06 mg/L)
- Chronic toxicity : Not classified

### Fish

- Cobalt hydroxide oxide : 96hr-LC<sub>50</sub> (*Oncorhynchus mykiss*) = 1.5 mg/L (ASTM guideline), NOEC=351.4µg/L
- Graphite : 96hr-LC<sub>50</sub> > 100 mg/L
- Aluminum : 96hr-LC<sub>50</sub> > 218.64 mg/L (GLP)(Read across; aluminium chloride hexahydrate), 28d-NOEC (*Pimephales promelas*) = 4.7 mg/L (Read across; aluminium sulphate)
- Lithium carbonate;Lithane : 96hr-LC<sub>50</sub> = 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)
- Ethyl methyl carbonate : 96hr-LC<sub>50</sub> > 100 mg/L (OECD Guideline 203, GLP)
- Tricobalt tetraoxide : 96hr-LC<sub>50</sub> > 136 mg/L (OECD TG 203, GLP), 34d-NOEC(*Pimephales promelas*) = 0.21 mg/L
- 1,3-Dioxolan-2-one : 96hr-LC<sub>50</sub> > 100 mg/L (OECD Guideline 203, GLP)
- Carbonic acid diethyl ester : 96hr-LC<sub>0</sub> ≥ 65 mg/L (GLP)
- Lithium hexafluorophosphate(1-) : 96hr-LC<sub>50</sub> = 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
- Carbon black : 96hr-LC<sub>0</sub> = 1000 mg/L (OECD Guideline 203, GLP)
- Fe : 96hr-LC<sub>50</sub> > 10000 mg/L (OECD TG 203, GLP)
- Manganese : 96hr-LC<sub>50</sub> > 3.6 mg/L (OECD TG 203, GLP)
- 1,3-propanesultone : 96hr-LC<sub>50</sub>(*Leuciscus idus*) = 420 mg/L (OECD Guideline 203, GLP)

### Crustacean

- Cobalt hydroxide oxide : 48hr-LC<sub>50</sub> (*Daphnia magna*) > 64.8 mg/L (OECD Guideline 202, GLP)
- Graphite : 48hr-EC<sub>50</sub> > 100 mg/L
- Aluminum : 48hr-LC<sub>50</sub> = 0.071 mg/L (Read across; CAS 13473-90-0), 8d-NOEC (*Ceriodaphnia dubia*) = 4.9 mg/L (Read across; CAS 7784-13-6)
- Lithium carbonate;Lithane : 48hr-EC<sub>50</sub> = 33.2 mg/L (OECD Guideline 202, GLP), 21d-NOEC (*Daphnia magna*) = 9 mg/L (Read across; lithium)(OECD Guideline 211, GLP)
- Ethyl methyl carbonate : 48hr-EC<sub>50</sub> > 100 mg/L (OECD Guideline 202, GLP)
- Tricobalt tetraoxide : 48hr-LC<sub>50</sub> > 136 mg/L (OECD TG 203, GLP)
- 1,3-Dioxolan-2-one : 48hr-EC<sub>50</sub> > 100 mg/L (OECD Guideline 202, GLP)
- Carbonic acid diethyl ester : 48hr-LC<sub>50</sub> = 102.497 mg/L (Ecosar ; ester)
- Lithium hexafluorophosphate(1-) : 48hr-LC<sub>50</sub> > 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)
- Carbon black : 24hr-EC<sub>50</sub> > 5600 mg/L (OECD Guideline 202, GLP)
- Fe : 48hr-EC<sub>50</sub> > 100 mg/L (OECD TG 202, GLP)
- Manganese : 48hr-EC<sub>50</sub> > 1.6 mg/L (OECD TG 202, GLP), 8d-NOEC (*Ceriodaphnia dubia*) = 1.7 mg/L (OECD TG 211, GLP)
- 1,3-propanesultone : 48hr-EC<sub>50</sub>(*Daphnia magna*) = 16 mg/L (OECD Guideline 202, GLP)

### Algae

- Cobalt hydroxide oxide : 72hr-EC<sub>50</sub> (*Selenastrum capricornutum*) = 0.043 mg/L (OECD Guideline 201, GLP)
- Graphite : 72hr-EC<sub>50</sub> > 100 mg/L
- Aluminum : 72hr-EC<sub>50</sub> = 0.0169 mg/L (OECD TG 201), (Read across; CAS 13473-90-0)
- Lithium carbonate;Lithane : 72hr-EC<sub>50</sub> > 400 mg/L
- Ethyl methyl carbonate : 72hr-EC<sub>50</sub> > 62 mg/L (OECD Guideline 201, GLP), , 72h-NOEC(*Scenedesmus subspicatus*) = 50 mg/L (OECD Guideline 201, GLP)



- Tricobalt tetraoxide : 72hr-EC<sub>50</sub> = 88 mg/L (OECD TG 201, GLP), 72hr-NOEC(*Selenastrum capricornutum*) = 9.8 mg/L
- 1,3-Dioxolan-2-one : 72hr-EC<sub>50</sub> > 100 mg/L (OECD Guideline 201, GLP), 72hr-NOEC(*Selenastrum capricornutum*) = 100mg/L(OECD Guideline 201, GLP)
- Carbonic acid diethyl ester : 72hr-EC<sub>50</sub> > 100 mg/L (OECD TG 201, GLP)
- Lithium hexafluorophosphate(1-) : 96hr-EC<sub>50</sub> > 100 mg/L ; 96h-NOEC = 22 mg/L (OECD Guideline 201, GLP)
- Carbon black : 72hr-EC<sub>50</sub> > 10000 mg/L , 72hr-NOEC > 10,000mg/L (OECD Guideline 201, GLP)
- Manganese : 72hr-EC<sub>50</sub> = 4.5 mg/L (OECD TG 201, GLP), 72hr-NOEC (*Scenedesmus subspicatus*) = 2.5 mg/L (OECD TG 201, GLP)
- 1,3-propanesultone : 72hr-EC<sub>50</sub>(*Desmodesmus subspicatus*) > 320 mg/L (OECD Guideline 201, GLP)

## 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)
- Ethyl methyl carbonate : Low persistency (log Kow is less than 4 estimated.) (Log Kow = 0.972) (40 °C, pH 6.8)
- 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)
- Carbonic acid diethyl ester : Low persistency (log Kow is less than 4 estimated.) (Log Kow = 1.21) (25 °C)
- 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)
- Butanedinitrile : Low persistency (log Kow is less than 4 estimated.) (Log Kow = -0.99)

### Degradability

- Carbonic acid diethyl ester : Vapor-phase diethyl carbonate is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals (SRC); the half-life for this reaction in air is estimated to be 5 days
- 1,3-propanesultone : Low persistency (log Kow is less than 4 estimated.) (log Kow = -2.86 ) (QSAR)

## 12.3. Bioaccumulative potential

### Bioaccumulation

- Graphite : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 2.433)
- Aluminum : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 3.162) (estimated)
- Copper : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 0.02 ~ 20)
- Ethyl methyl carbonate : 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)
- Carbonic acid diethyl ester : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 2) (estimated)
- Lithium hexafluorophosphate(1-) : Bioaccumulation is expected to be low according to the BCF < 500 (BCF < 31)
- Butanedinitrile : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 3) (estimated)
- Nickel; Raney nickel : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 70)
- 1,3-propanesultone : Bioaccumulation is expected to be low according to the BCF < 500 (BCF = 3.162) (estimated)

### Biodegradation



- Ethyl methyl carbonate : As well-biodegraded, it is expected to have low accumulation potential in living organisms (= 98% 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)
- Polyethylene : As not well-biodegraded, it is expected to have high accumulation potential in living organisms (= 0% biodegradation was observed after 28 days)
- Carbonic acid diethyl ester : As well-biodegraded, it is expected to have low accumulation potential in living organisms (= 75% biodegradation was observed after 27 days) (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)
- Butanedinitrile : As not well-biodegraded, it is expected to have high accumulation potential in living organisms (= 45.1% biodegradation was observed after 4 days)
- Carbon black : carbon black is an inorganic substance and will not biodegraded by microorganisms.
- 1,3-propanesultone : As well-biodegraded, it is expected to have low accumulation potential in living organisms(89% biodegradation was observed after 28 days) (OECD Guideline 301E, GLP)

#### 12.4. Mobility in soil

- Ethyl methyl carbonate : Low potency of mobility to soil. (Koc = 1.58) (40 °C)(OECD Guideline 121, GLP)
- 1,3-Dioxolan-2-one : Low potency of mobility to soil. (Koc = 3.219) (estimated)
- Carbonic acid diethyl ester : Low potency of mobility to soil. (Koc = 100) (estimated)
- Butanedinitrile : Low potency of mobility to soil. (Koc = 28) (estimated)
- Nickel; Raney nickel : Low potency of mobility to soil. (Koc = 2.86)
- Manganese : Kd = 994 (OECD TG 106)
- 1,3-propanesultone : No potency of mobility to soil. (Koc = 16.8) (QSAR)

#### 12.5 Results of PBT and vPvB assessment : Not available

#### 12.6 Other adverse effects : Not available

## Section XIII – DISPOSAL CONSIDERATION

### 13.1 Waste treatment methods

#### Product/Packaging disposal

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

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

#### Waste treatment-relevant information

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

**Sewage disposal-relevant information:** Not available

**Other disposal recommendations:** Not available

## Section XIV – TRANSPORTATION INFORMATION

※ If those lithium-ion batteries are packed with or contained in an equipment, then it is the responsibility of the shipper to ensure that the consignment are packed in compliance to the latest



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

**14.1 UN Number :** 3480

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

**14.3 Transport Hazard class :** 9

**14.4 Packing group :** II

**14.5 Special provisions :** 188, 230, 384

**14.6 Packing instructions :** P903

**14.7 Environmental hazards :** No

**14.8 Special precautions for user**

in case of fire : F-A

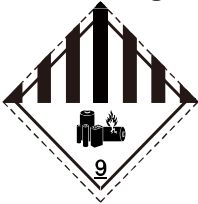
in case of leakage : S-I

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

Available

**14.10 IATA Transport :** PI 965-Section IB (61st edition)

**14.11 Package labels**



**14.12 Test Results of the UN Recommendation on the Transport of Dangerous Goods**

Our products are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation according to all the applicable international and national governmental regulations, not limited to the above mentioned. We further certify that the enclosed products have been tested and fulfilled the requirements and conditions in accordance with UN Recommendations (T1 – T8) on the Transport of Dangerous Goods Model Regulations and the Manual of Testes and Criteria.



**Test results of the UN Recommendation on the Transport of Dangerous Goods**

Manual of Test and Criteria (38.3 Lithium batteries)		Test Results	Remark
No	Test item		
T1	Altitude Simulation	Pass	
T2	Thermal Test	Pass	
T3	Vibration	Pass	
T4	Shock	Pass	
T5	External Short Circuit	Pass	
T6	Impact/Crush	Pass	
T7	Overcharge	Pass	For pack and single cell battery only
T8	Forced Discharge	Pass	

## Section XV – REGULATORY INFORMATION

### 15.1 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:**

**Candidate List of substances of very high concern for Authorisation**

- 1,3-propanesultone : Regulated

#### 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

- Nickel : 100 lb

- 1,3-propanesultone : 10 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) :**

- Cobalt, Co : Regulated

- Aluminium (metal) : Regulated

- lithium carbonate

- Copper : Regulated

- Nickel : Regulated

- Manganese : Regulated

- 1,3-propanesultone : Regulated

**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 XVI – OTHER INFORMATION EU

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** : 14 Feb. 2019

**Version** : Rev. 02

#### 16.2 Abbreviations and acronyms

**ACGIH** = American Conference of Government Industrial Hygienists

**CLP** = Classification Labelling Packaging Regulation ; Regulation (EC) No 1272/2008

**CAS No.** = Chemical Abstracts Service number

**DMEL** = Derived Minimal Effect Levels

**DNEL** = Derived No Effect Level

**EC Number** = EINECS and ELINCS Number (see also EINECS and ELINCS)

**EU** = European Union

**IARC** = International Agency for Research on Cancer

**ISHL** = Industrial Safety & Health Law

**NIOSH** = National Institute for Occupational Safety & Health

**NTP** = National Toxicology Program

**OSHA** = European Agency for Safety and Health at work

**PBT** = Persistent, Bioaccumulative and Toxic substance

**PNEC(s)** = Predicted No Effect Concentration(s)

**REACH** = Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (EC) No 453/2010

**STP** = Sewage Treatment Plant

**SVHC** = Substances of Very High Concern

**vPvB** = Very Persistent and Very Bioaccumulative

**UN** = United Nations

**MARPOL** = International Convention for the Prevention of Pollution from Ships (IMO)

**IBC** = Intermediate Bulk Container

**CERCLA** = Comprehensive Environmental Response, Compensation & Liability Act (US)

**EPCRA** = Emergency Planning and Community Right-to-Know Act (US)

**EINECS** = European Inventory of Existing Commercial chemical Substances

**ELINCS** = European List of Notified Chemical Substances





### 16.3 Key literature reference and sources for data :

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/episuitedi.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 warranty 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.





**17. Appendix A**

**Section 1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING**

In addition to the information in **Product Identifier** and **Further Information** section of the original manufacturer prepared SDS, the following information also applies for Dell products:

Type Number	Dell P/N	Nominal Voltage (V)	Rated Capacity (Ah)	Wh Rating (Wh)
3DDDQ	45N3J	11.4	3.500	42
33YDH	J9NH2, W7NKD	15.2	3.500	56
WDX0R	FC92N, C4HCW, CYMGM	11.4	3.500	42
7CJRC	V6VMN	11.4	3.500	42
0JV6J	PGYK5	7.6	4.013	32
357F9	0GFJ6	11.1	6.333	74
VVKCY	098N0	11.1	5.605	66
1KFH3	MM4H1	11.1	5.605	66
PDNM2	579TY	11.1	3.166	37
M5Y1K	07G07	14.8	2.660	40
5R9DD	XKPD0	11.1	3.705	43
D2VF9	YGR2V	11.1	3.705	43
4P8PH	179F8	7.4	7.410	56
5MTD8	VDYR8	7.4	5.610	43
0PD19	86JK8	7.4	7.410	58
TRHFF	VVMKC	11.1	3.705	43
CB1C13	1132N	11.4	4.336	50
CGMN2	N33WY	11.4	4.275	50
F7HVR	62VNH	14.8	3.705	58
VV0NF	CXF66, 7W6K0	11.1	5.605	65
VJXMC	C0MXV	14.8	2.660	40



**18. Appendix B**

Subject : Amendment to original SDS prepared by the manufacturer

**Section 1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING**

In addition to the information in **Company/undertaking Identification** section of the original manufacturer prepared SDS, the following information also applies for Dell products:

**Supplier's Details**

Supplier's Details	Dell Inc. One Dell Way Round Rock, TX 78682
Emergency Telephone Number	CHEMTREC North America 800 424 9300  International 1 703 527 3887
For Australia only Supplier's Details	Dell Australia Pty Limited Building 3 14 Acquatic Drive French's Forest Sydney, NSW Postcode 2086 +61 2 8223 9403
Australia Emergency Telephone Number	CHEMTREC Australia (Sydney) +61 2 9037 2994
Prepared by	Global Product Compliance, Dell Inc.