# MATERIAL SAFETY DATA SHEET

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## Kokam SLPB Material Safety Data Sheet

### Section 1 Chemical Product And Company Identification

| | |
|---|---|
| **Product Name:** | Superior Lithium Polymer Battery (SLPB) |
| **Battery Type:** | Rechargeable Battery |
| **Description:** | Lithium Cobalt Manganese Nickel Oxide |
| **Model:** | SLPB Series |
| **Electrochemical System:** | Negative Electrode : Carbon<br>Positive Electrode : Lithium Cobalt Manganese Nickel Oxide ($LiMnNiCoO_2$)<br>Electrolyte : Solution of lithium hexafluorophosphate ($LiPF_6$) in a mixture of organic solvent _ Ethylene Carbonate(EC) + Ethymethyl Carbonate(EMC) |
| **Overall Chemical Reaction:** | $Li_xC_6 + Li_{1-x} \leftrightarrow C_6 + LiMnNiCoO_2$ |

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|---|---|
| **Manufactured by:** | Kokam Co., Ltd. |
| **Address:** | Head office : 30-78, Gyeongsu-daero 1220beon-gil, Jangan-gu, Suwon-si, Gyeonggi-Do, South Korea 440-851<br>Factory : 19, Gayagongdan-gil, Gayagok-myeon, Nonsan-si, Chungcheongnam-do, South Korea 320-844 |

| | |
|---|---|
| **Emergency Situation** | For Chemical Emergency<br>Spill, Leak, Fire, Exposure, or Accident<br>Call CHEMTREC Day or Night<br>Within USA and Canada: 1-800-424-9300 CCN200262<br>Outside USA and Canada: +82 31-362 0100 |
| **Technical Information** | 82-31-362-0100 or 82-41-740-3800 |
| **Date Prepared :** | August 21, 2006 |
| **Revision No :** | 13 |
| **Revision Date :** | September 17, 2013 |

## Section 2 Definition of Hazards

**Emergency overview:**

- Do not open or disassemble.
- Do not expose to fire or open flame.
- Do not mix with batteries of varying sizes, chemistries or types.
- Do not puncture, deform incinerate or heat above 85℃.

**Potential health effects:**

The materials contained in this battery may only represent a hazard if the integrity of the battery is compromised or if the battery is physically or electrically abused.

(1) Physical:

- The Lithium ion polymer rechargeable batteries described in this Material Safety Data Sheet are sealed units which are not hazardous when used according to the recommendations of the manufacturer.
- Under normal conditions and use, the solid electrode materials and liquid electrolyte they contain are non-reactive provided the battery integrity is maintained and seals remain intact.
- Risk of exposure is only in case of abuse (mechanical, thermal, electrical) leading to the activation of safety valves and/or the rupture of the battery containers. Electrolyte leakage, electrode materials reaction with moisture/water or battery vent/explosion/fire may follow, depending upon the circumstances.

(2) Chemical:

**Classification of dangerous substances contained into the product**

**As per directive 67/548/EEC**

| Substance | | Melting Point | Boiling Point | Classification | | | |
|---|---|---|---|---|---|---|---|
| CAS No. | Chemical Symbol | | | Exposure Limit | Indication of danger | Special risk(1) | Safety advice(2) |
| 182442-95-1 | $LiMnNiCoO_2$ | >1000℃ | N/A | 0.1mg/$m^3$ as Co<br>1.0mg/$m^3$ as Ni<br>OSHA | | R22<br>R43 | S2 S22<br>S24 S26 S36 |
| EC : 96-49-1<br>EMC : 623-53-0 | Organic Solvents (EC-EMC) | EC : 38℃<br>EMC : 4℃ | EC : 243℃<br>EMC : 90℃ | None established<br>OSHA | Flammable | R21 R22<br>R41<br>R42/43 | S2 S24<br>S26 S35<br>S37 S45 |
| 21324-40-3 | LiPF6 | N/A<br>(decomposes at 160℃) | N/A | None established<br>OSHA | Irritant<br>Corrosive | R14<br>R21 R22<br>R41 R43 | S2 S8 S22<br>S24 S26 S36<br>S37 S45 |

1) **Nature of special risks**:

| | |
|---|---|
| R14 | Reacts with water |
| R21 | Harmful in contact with skin |
| R22 | Harmful is swallowed |
| R41 | Risk of serious eye damage |
| R42/43 | May cause irritation when inhaled or when substances come in contact with skin |
| R43 | May cause irritation when substances come in contact with skin |

2) **Safety recommendations:**

| | |
|---|---|
| S2 | Keep out of reach from children |
| S8 | Keep away from moisture |
| S22 | Do not breathe dust |
| S24 | Avoid contact with skin |
| S26 | In case of contact with eyes, rinse immediately with plenty of water and seek medical attention |
| S36 | Wear suitable protective clothing |
| S37 | Wear suitable gloves |

## Section 3 Product Composition

| Chemical Name | CAS # | ACGIH TLV | Percent of Content |
|---|---|---|---|
| Lithium Cobalt Manganese Nickel Oxide($LiMnNiCoO_2$) | 182442-95-1 | 0.02mg/$m^3$ as Co<br>0.2mg/$m^3$ as Mn<br>0.2mg/$m^3$ as Ni | 20-50 |
| Carbon(Graphite, Proprietary) | 7782-42-5 | 2mg/$m^3$ (R) | 15-35 |
| PVDF(Polyvinylidene Fluoride) | 24937-79-9 | | <8 |
| Aluminum Foil | 7429-90-5 | | 3-12 |
| Copper Foil | 7440-50-8 | | 3-12 |
| Electrolyte | EC : 96-49-1<br>EMC : 623-53-0<br>LiPF6 : 21324-40-3 | | 10-20 |
| Al Film Cover | N/A | | <5 |
| **Chemical Name** | **CAS #** | **ACGIH TLV** | **Percent of Content** |
| Lithium Cobalt Manganese Nickel Oxide($LiMnNiCoO_2$) | 182442-95-1 | 0.02mg/$m^3$ as Co<br>0.2mg/$m^3$ as Mn<br>0.2mg/$m^3$ as Ni | 20-50 |

**The balance of the battery is inert materials**

- **ACGIH: American Council of Government Industrial Hygienists**
- **TLV: Threshold Limit Value are personal exposure limits determined by the ACGIH**

## Section 4 First Aid Measures

In the event of battery rupture or explosion, evacuate personnel from contaminated area and provide maximum ventilation to clear out fumes/gases. In all cases, seek immediate medical attention.

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|---|---|
| **Eye Contact:** | Flush with plenty of water (eyelids held open) for at least15 minutes. |
| **Skin Contact:** | Remove all contaminated clothing and flush affected areas with plenty of water and soap for at least 15 minutes.<br>Do not apply grease or ointments. |
| **Ingestion:** | Dilute by drinking plenty of water and seek immediate medical attention.<br>If substances are swallowed, be sure that aspiration of vomit does not occur<br>Ensure that mucus does not obstruct the airway.<br>Do not prescribe oral medication/aid to an unconscious person. |
| **Inhalation:** | Ventilate the contaminated area and evacuate affected personnel.<br>Provide oxygen or artificial respiration, if necessary. |

## Section 5 Firefighting Measures

**Fire and Explosion Hazards:**

The battery can leak and/or release vaporized or decomposed and combustible electrolyte fumes when exposed to temperatures above 70℃; when improperly handled; or due to the environment.

Cells or batteries may flame or leak potentially hazardous vapors if exposed to excessive heat or fire. Fire, excessive heat, or over voltage can potentially be hazardous and lead to decomposition of products.

Damaged or opened cells or batteries can result in rapid heating and the release of flammable vapors.

Vapors may be heavier than air and may travel on ground or be moved by ventilation to an ignition source and flash back.

Use a positive pressure self-contained breathing apparatus if batteries are contained in a fire. Full protective clothing is necessary. During water application, caution is advised as burning pieces of flammable particles may be ejected from the fire.

**Extinguishing Media:** Suitable: $CO_2$, Water

Dry chemical or Foam extinguishers or Type D extinguishers

**Special Exposure Hazards:** If cells overheat due to an external source or improper use, electrolyte leakage or battery container rupture may occur and release inner component/material in the environment.

**Eye contact:** The electrolyte solution contained in the battery is an irritant and can damage ocular tissues.

**Skin contact:** The electrolyte solution contained in the battery causes skin irritation.

**Ingestion:** The ingestion of electrolyte solution causes tissue damage to throat and gastro/respiratory tract.

**Inhalation:** Contents of a leaking or ruptured battery can cause respiratory tract, mucus, membrane irritation and edema.

**Special Protective Equipment:** Use self-contained breathing apparatus to avoid breathing irritant fumes. Wear protective clothing and wash the body with an electrolyte solution.

## Section 6 Accidental Release Measures

The material contained within the batteries can only be expelled under abusive conditions.

Using a shovel or broom, cover the battery or expelled substances with dry sand or vermiculite. Place the battery in a separate container (after cooling, if necessary) and dispose in accordance with local regulations.

## Section 7 Handling and Storage

Batteries should not be disassembled, destroyed or incinerated as they may leak, rupture and release chemicals into the environment.

**Handling:**

Batteries are designed to be recharged. However, improperly charging a cell or battery may cause the cell or battery to ignite.

Use only approved chargers and follow standard operating procedures.

Never disassemble a battery or bypass any safety device.

Do not crush, pierce, short (+) and (-) battery terminals with conductive (i.e. metal) goods.

Do not directly heat or solder.

Do not throw into fire.

Do not mix batteries of different types and brands.

Do not mix new and used batteries.

Keep batteries in non conductive (i.e. plastic) trays.

**Storage:**

Do not store batteries above 60℃ or below -20℃.

Store batteries in a cool (below 30℃), dry area that is subject to little temperature change.

Elevated temperatures can result in reduced battery service life.

Battery exposure to temperatures in excess of 130℃ will result in the battery emitting flammable liquid and gases.

Batteries should be separated from other materials and stored in a noncombustible, well ventilated, sprinkler-protected structure with sufficient clearance between walls and battery stacks.

Do not store batteries in a manner that allows terminals to short circuit.

Extended short-circuiting creates high temperatures in the cell. High temperatures can cause skin irritation or cause the cell to flame.

Avoid reversing battery polarity within the battery assembly. Doing so may cause the cell to ignite or to leak.

Do not place batteries near heating equipment, or expose to direct sunlight for long periods.

**Other:** Follow the manufacturer's recommendations regarding maximum recommended currents and operating temperature range. Applying pressure to the battery may cause disintegration, releasing irritant materials that are hazardous to the eye, skin, and throat.

## Section 8 Exposure Controls / Protective Measures

No engineering controls are required for handing batteries that have not been damaged.

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| **Respiratory protection:** | *Not necessary under normal use.* |
| | In event of battery rupture, use self-contained full-face respiratory equipment. |
| **Hand Protection:** | *Not necessary under normal use.* |
| | Use gloves when handling a leaking or ruptured battery. |
| **Eye Protection:** | *Not necessary under normal use.* |
| | Wear safety goggles/glasses with side shields if handling a leaking or ruptured battery. |
| **Skin Protection:** | *Not necessary under normal use.* |
| | Use rubber protective working when handling of a ruptured battery. |

## Section 9 Physical And Chemical Properties

**Temperature Range:**

| | Continuous | Occasional |
|---|---|---|
| In storage | +30℃ max | -20/+60℃ |
| During discharge | -20/+60℃ | -20/+60℃ |
| During charge | 0/+45℃ | 0/+45℃ |

## Section 10 Stability And Reactivity

**Conditions to Avoid:** Heat above 60℃

Deform, mutilate, crush, pierce, disassemble.

Short circuit

Prolonged exposure to humid conditions

**Materials to avoid:** N/A

**Hazardous Conditions:** Fire, excessive heat, or over voltage may result in decomposition of product.

## Section 11 Toxicological Information

(1) Irritancy: The electrolytes contained in this battery can irritate eyes with any direct contact. Prolonged contact with the skin or mucous membranes may cause irritation.

(2) Sensitization: No information is available at this time.

(3) Carcinogenicity: No information is available at this time.

(4) Reproductive toxicity: No information is available at this time.

(5) Teratogenicity: No information is available at this time.

(6) Mutagenicity: No information is available at this time.

## Section 12 Ecological Information

Not applicable to this material / product.

## Section 13 Disposal Considerations

- Dispose in accordance with applicable regulations according to country.
  (In most countries, the disposal of used batteries is forbidden and the end-users are invited to dispose them properly, eventually through not-for-profit or profit organizations, mandated by the local government or organized on a voluntary basis by professionals).
- Batteries should be completely discharged prior to disposal and/or the terminals taped or capped to prevent short circuit.
- When completely discharged, it is not considered hazardous.
- This product does not contain any materials listed by the United Stated EPA as requiring specific waste disposal requirements.
- These are exempted from the hazardous waste disposal standards under Universal Waste Regulations. Disposal of large quantities of Lithium-ion batteries or cells may be subject to federal, state, or local regulations.
- Consult your local, state and provincial regulations regarding disposal of these batteries.

## Section 14 Transporting Product

United Nations

– UN 3480
– Class 9
– Proper shipping name: LITHIUM ION BATTERIES
– Packing group II

International Conventions

ADR/ RID - Transportation by Road/Rail

– UN 3480
– Class 9
– Proper shipping name: LITHIUM ION BATTERIES
– Packing group II
– Packing instruction P903

IMDG - Sea Transportation

– UN 3480
– Class 9
– Proper shipping name: LITHIUM ION BATTERIES

– Packing group II

– Packing instruction P903

– Emergency Schedule F-A, S-I

– Marine pollutant: NO

IATA - AIR Transportation

– UN 3480

– Class 9

– Proper shipping name: LITHIUM ION BATTERIES

– Packing group II

– Packing instruction 965 Section IA

Other: in USA Code of Federal Regulation, 49 CFR Ch.1 § 173-185

Label


## Section 15 Regulatory Information

The transport of rechargeable Lithium-ion batteries are regulated by the United Nations as detailed in the "UN Recommendations on the Transport of Dangerous Goods – Model Regulations, ST/SG/AC.10/1/Rev.17". Batteries conform to "UN Recommendations on the Transport of Dangerous Goods - Manual of Tests and Criteria, ST/SG/AC.10/11/Rev.5/Amend.1, Chapter 38.3".

## Section 16 Other Information

This information has been compiled from sources considered to be dependable and is, to the best of our knowledge and belief, accurate and reliable as of the date compiled. However, no representation, warranty (ether expressed or implied) or guarantee is made to the accuracy, reliability or completeness of the information contained herein.

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