GHS Safety Data Sheet

MSDS No.: ZRR09LAEG

Date Issued: 2013/04/02

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

1.1 Product Information

Product name: Zr(O-n-C₄H₉)4 in n-C₄H₉OH Zirconium tetra-n-butoxide, n-butanol

| Product number | Purity | Form |
|----------------|--------|--------|
| ZRR16LB | — | liquid |

1.2 Company Information:

Manufacturer : Kojundo Chemical Laboratory Co., Ltd. 1-28, 5-chome, Chiyoda, Sakado-shi, Saitama Japan 350-0284 Phone: +81-49-284-1511 Fax: +81-49-284-1351

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Section 2. Hazards identification

GHS Classification

| Health Hazards | Environmental Hazards | Physical Hazards |
|--|-----------------------|--|
| Acute toxicity(Oral) : Category 4 Skin corrosive/irritation : Category 2 Serious eye damage/ eye irritation : Category 2 Specific target organ toxicity, repeated exposure : Category 1 | No data available | Flammable liquids : Category 3 Pyrophiric liquids : Not classified. Self-heating substances and mixtures : Not classified. Substances and mixtures which, in contact with water, emit flammable gases : Not classified Corrosive to metals : Not classified |
| GHS Label: FCW | | |

per



| Pictograms or symbols | \mathbf{v} \mathbf{v} |
|---|--|
| Warning word: DANGER | |
| Hazard information | Description of precaution |
| Flammable liquid and vapor. Harmful if swallowed Causes skin irritation. Causes serious eye damage. Causes damage to organs(Central nervous system, auditory organ) through prolonged or repeated exposure. | Keep away from heat/sparks/open flames/hot surfaces. No smoking. Use explosion-proof equipment(e.g. electrical /lighting/ventilating). Take precautionary measures static discharge. Wear protective gloves/protective clothing/eye protection /respiratory protection /face protection during handling. Avoid breathing dust/mist/fume/vapors/spray. Do not eat, drink or smoke when using this product, and wash hands thoroughly after handling. Take off the contaminated clothing and wash before reuse. Keep container or bottle tightly closed when not in use. Use only outdoors or in well-ventilated area. IN CASE OF FIRE: Use Carbon dioxide, Dry chemical powder, Water fog or foam for extinction. DO NOT use a direct water stream. IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Rinse mouth. IF ON SKIN: Take off immediately all contaminated clothing and rinse skin with water/shower. Then wash skin with plenty of soap and water. If skin irritation occurs, get medical advice/attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a POISON CENTER or doctor/physician if you feel unwell. Protect from sunlight. Store in a cool, dry and well ventilated place. Keep container tightly closed. Dispose of contents/ container in accordance with local/national regulations. |

Additional hazard information :

With respect to additional hazard information, see Section 11.

| - | | | | | |
|----------------------------|----------------------|-----------|----------------|------------|---------|
| Hazardous Ingredient | Hazardous Ingredient | | | nent (wt%) | |
| Zirconium tetra-n-but | oxide | | 80~90 | | |
| 1-Butanol(n-Butanol) | | 10~20 | | | _ |
| Chemical name | Chemical formula | CAS# | TSCA Inventory | RTECS# | EINECS# |
| Zirconium tetra-n-butoxide | $Zr(O-n-C_4H_9)_4$ | 1071-76-7 | listed | _ | 2139953 |
| 1-Butanol | CH3 (CH2)3OH | 71-36-3 | listed | EO1400000 | 2007516 |
| | | | | | |

Section 3. Composition / information on ingredients

(See Section 8 for Exposure Limits)

| Section 4. | First aid measures | | | | | |
|---------------|--|--|--|--|--|--|
| Eye contact: | Promptly rinse eyes with plenty of water while lifting the eye lids. Continue to | | | | | |
| | rinse for at least 15 minutes and get medical attention. | | | | | |
| Skin contact: | Remove immediately all contaminated clothing. Wipe off the product immediately | | | | | |
| | by tissue or soft cloth, etc. Promptly flush contaminated skin with soap or mild | | | | | |
| | detergent and water. Contact physician if irritation continues. | | | | | |
| Ingestion: | Rinse mouth and throat with water. Get medical attention immediately. | | | | | |
| Inhalation: | Remove the exposed person immediately and provide fresh air. | | | | | |
| | Get medical attention. | | | | | |

Section 5. Fire fighting measures

| Chemical N | Name | Flash Point | Autoignition Temperature | Explosion Level (Lower-Upper) | Vapor Pressure |
|------------|------|-------------|--------------------------|----------------------------------|----------------|
| 1-Butanol | | 29°C | 345°C | 1.4 ~ 11.2 % | 580Pa/20°C |

Extinguishing agents:

| | Carbon dioxide, Dry chemical powder, Water fog or foam. |
|------------------|--|
| | DO NOT use a direct water stream. |
| Fire fighting: | Flammable material. Burning material releases toxic organic fumes. |
| | Remove containers to safe place if possible. |
| | Use water spray to Cool down nearby structures and containers. |
| | Self-contained breathing apparatus and full protective clothing should be used, if the |
| | material is involved in fire. |
| Explosion hazard | ls: Heating may cause an explosion. |
| Combustion prod | ucts: |
| | Carbon monoxide, carbon dioxide, metallic oxide of zirconium and toxic organic |
| | fumes. |
| Section 6. | Accidental release measures |
| Personal Precaut | tions: Workers should use protective wears to prevent contact with the spilt adhesive and inhalation of its vapor. |

Environmental hazard precautions:

Shut off leak if without risk.

Prevent flow out to river, etc. so as not to badly affect.

Method for containment and cleaning up:

Wear respirator, chemical safety goggles, rubber boots and heavy rubber gloves. Wear disposable coveralls and discard them after use. Remove all sources of ignition.

Avoid unnecessary contacts with spills.

Indoor leakage: Ventilate as much as possible until the cleaning is completed. Outdoor leakage: Work from the windward and evacuate the leeward crowd. Absorb or cover with inert material(e.g. vermiculite, sand, earth or other suitable absorbent), then place in closed dry container. Ventilate area and carefully wash spill site with plenty of water after material pick up.

Section 7. Handling and storage

| Precautions | to b | e taken | in | hand | ling: |
|-------------|------|---------|----|------|-------|
| 1 recaulons | 0.0 | e tanen | | nanu | mig. |

| Safe handling: | Keep container or bottle tightly closed when not in use. | | | | |
|-------------------------|---|--|--|--|--|
| | Avoid prolonged or repeated exposure. | | | | |
| | Handling worker wears suitable protective clothing. | | | | |
| | Keep away from heat, sparks and naked flame. | | | | |
| | Electrically ground all equipment when handling this material and use only | | | | |
| | non-sparking tools. | | | | |
| | Use explosion-proof electrical/ventilating/lighting equipment. | | | | |
| Precautions to be taken | in storage: | | | | |
| General precautions: | Store in a cool, dry, well ventilated and dark place away from incompatible | | | | |
| | materials. | | | | |
| | Keep away from any heat, sparks, and flames. | | | | |

| Section 8. Exposure controls / personal protection | | | | | | | |
|--|--|-------------------------|---------------------|-------------------|----------------------|--|--|
| Exposure guideline: | | | | | | | |
| Classic | 1 N | ACGIH(2012)TLV | | OSHA(2006)PEL-TWA | | | |
| Cnemica | I Name | TWA(mg/m ³) | STEL(ppm) | (ppm) | (mg/m ³) | | |
| Zirconium compounds (as Zr) | | 5 | 10 mg/m^3 | — | 5 | | |
| 1-Butanol | | 20ppm | _ | 100 | 300 | | |
| Facility measures: | Local ventilation inhalation. | of closed work re | oom or total pro | per ventilati | ion to prevent | | |
| Protective ware: | Wear appropriate NIOSH/MSHA-approved respirator, safety goggles, | | | | | | |

impervious gloves, protective wear, protective boots.

| Section 9. Physical and chemical properties | | | | | | |
|---|--|------------------|---------------|------------------|-----------------------------|--|
| Color and Form: Density: | Clear pale yellow $11.06 \text{ g/cm}^3(25)$ | liquid, n-butano | ol odor. | | | |
| Chemical Name | Molecular Weight | Melting Point | Boiling Point | Relative Density | Solubility/H ₂ O | |
| 7 | 202 7 | | 000 / 19 9D- | 1.07* | 1 | |

| Zirconium tetra- | n-butoxide 383.7 | - | 260 / 13.3Pa | 1.07* | decompose |
|------------------|-------------------------------|---------------|------------------------|---------------------|-----------|
| 1-Butanol | 74.1 | -90 | 117 | 0.81 | soluble |
| | Melting Point, Boiling Point; | Relative dens | sity;water=1, *:Densit | y;g/cm ³ | |

| Flammable: | flammable liquid |
|------------|------------------|
| Oxidation: | None |

Section 10. Stability and reactivity

| Stability: | Stable in closed container. |
|------------------------|---|
| Reactivity: | |
| Incompatibility; | Acid chlorides, acid anhydrides, oxidizing agents, reducing agents, copper, |
| | Copper alloys |
| Conditions to avoid; | Heat, sparks and flames. |
| Hazard decomposition p | oroducts: Zirconium oxides |

Toxicological information Section 11.

| Acute toxicity(Oral): | GHS : Category 4; Harmful if swallowed 1-Butanol : oral rat LD50=1227mg/kg(calculated value) Zirconium tetra-n-butoxide : No data available Acute toxicity (oral) estimate ATEmix = 1227 mg/kg; Not classified |
|----------------------------------|---|
| Acute toxicity(Dermal): | GHS : Not classified.; Falls below the lowest level. 1-Butanol : dermal rabbit LD50=3636mg/kg(calculated value) Zirconium tetra-n-butoxide : No data available Acute toxicity (dermal) estimate ATEmix > 2000 mg/kg; Not classified. |
| Acute toxicity | GHS: Not classified.; Falls below the lowest level. |
| (Inhalation- vapors): | 1-Butanol : Inhalation rat 8000ppm(24.2mg/m ³)/4hr |
| | the death was not observed |
| | Zirconium tetra-n-butoxide : No data available Acute toxicity (inhalashon-vapor) estimate ATEmix > 24.2mg/m ³ (8000ppm) ; Not classified. |
| Acute toxicity | GHS : No data available |
| (Inhalation-mist): | |
| Skin corrosive / irritation: | GHS : Category 2 ; Causes skin irritation 1-Butanol : Category 2 Zirconium tetra-n-butoxide : No data available |
| Serious eye damage / irritation: | GHS : Category 2 ; Causes serious eye irritation. 1-Butanol : Category 2A Zirconium tetra-n-butoxide : No data available |
| Respiratory sensitization: | GHS : No data available |
| Skin sensitization: | GHS : No data available |
| Germ cell mutagenicity: | GHS : No data available |
| Carcinogenicity: | GHS : No data available |
| Reproductive toxicity: | GHS : No data available |
| Specific target organ toxicity | |
| -single exposure | GHS : No data available 1-Butanol : Category 3 (May cause respiratory irritation, May cause drowsiness or dizziness) Zirconium tetra-n-butoxide : No data available |
| Specific target organ toxicity | |
| -repeated exposure: | GHS : Category 1 ; Causes damage to organs(Central nervous system, auditory organ) through prolonged or repeated exposure. 1-Butanol : Category 1(Central nervous system, auditory organ) |
| Aspiration hazard: | GHS : No data available 1-Butanol : Not classified. Zirconium tetra-n-butoxide : No data available |

Ecological information Section 12.

Ecotoxicity:

Hazards to the aquatic environment -acute toxicity: GHS: No data available 1- Not classified.; Fish(Oryzias latipes) LC50>100mg/L/96hr Zirconium tetra-n-butoxide : No data available. -chronic toxicity: GHS: No data available GHS: No data available Hazrdous the ozone layer: No Freon or Halon Fish toxicity: See for "Hazards to the aquatic environment-acute toxicity"

Degradability: No data available

Bioaccumulative potential: No data available

(ref.) Zr Biological half-life 450 day, Rate of absorption Oral=0.0001 Respiratory tract=0.25 Mobility in soil: No data available

| Section 13. Disr | posal considerations | |
|-----------------------------------|--|--|
| Disposal method: | User of the product should contract with the local government or | |
| | licensed 'Industrial Waste Haulers' for disposal of waste. | |
| Section 14. Transport information | | |
| IIN number | 1003 | |
| IATA shipping name: | Flammable liquid n.o.s. | |
| IATA classification: | Hazardous Class 3 | |
| IATA packing group: | Ш | |
| HS code: | 3824.90 | |
| Marine pollution: | Yes (n-Butanol) | |
| Postion 15 Degulatory information | | |

Section 15. Regulatory information

TSCA inventory: Zirconium tetra-n-butoxide, 1-Butanol; listed Please refer to any other local / national measures that may be relevant.

Section 16. Other information

The information described above is believed to be correct. However, Kojundo Chemical Lab. makes no representation, warranty nor guarantee of any kind with respect to the information on this data sheet or any use of the product based upon this information.