Copper Indium Sulfide / Zinc Sulfide Nanocrystals in Toluene

1. PRODUCT IDENTIFICATION

**Chemical Name:** Copper Indium Sulfide / Zinc Sulfide Nanocrystals  
**Supplier:** NNCrystal US Corporation 534 W Research Center Blvd., Ste 254, Fayetteville, AR 72701  
**Product Line:** CIS  
**Phone:** 479.595.0662  
**Recommended Use:** Research and development use only

2. HAZARDS IDENTIFICATION

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

- Flammable liquids (Category 2), H225
- Acute toxicity, Oral (Category 4), H302
- Skin irritation (Category 2), H315
- Eye irritation (Category 2A), H319
- Acute toxicity, Inhalation (Category 4), H332
- Reproductive toxicity (Category 2), H361
- Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336
- Specific target organ toxicity - repeated exposure (Category 2), H373
- Aspiration hazard (Category 1), H304
- Acute aquatic toxicity (Category 2), H401
- Acute toxicity, Dermal (Category 4), H312
- Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
- Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336
- Specific target organ toxicity - repeated exposure (Category 2), H373
- Aspiration hazard (Category 1), H304
- Acute aquatic toxicity (Category 2), H401

**GHS Label Elements:**

[Flame Exclamation Symbol]

**Signal Word:** Warning
Hazardous Statements

H225 Highly flammable liquid and vapor.
H304 May be fatal if swallowed and enters airways.
H302 + H312 + H332 Harmful if swallowed, in contact with skin or if inhaled
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.
H336 May cause drowsiness or dizziness.
H361 Suspected of damaging fertility or the unborn child.
H373 May cause damage to organs through prolonged or repeated exposure.
H401 Toxic to aquatic life.

Precautionary Statements

P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ventilating/lighting/equipment.
P242 Use only non-sparking tools. P243 Take precautionary measures against static discharge.
P260 Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.
P261 Avoid breathing dust/ fume/ gas/ mist/ vapors/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P280 Wear eye protection/face protection.
P280 Wear protective gloves/protective clothing.
P301 + P312 + P330 IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. Rinse mouth.
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P302 + P352 + P312 IF ON SKIN: Wash with plenty of soap and water. Call a POISON CENTER or doctor/physician if you feel unwell.
P304 + P340 + P312 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313 IF exposed or concerned: Get medical advice/attention.
P331 Do NOT induce vomiting.
P332 + P313 If skin irritation occurs: Get medical advice/attention.
P337 + P313 If eye irritation persists: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish P403 +
P233 Store in a well-ventilated place. Keep container tightly closed.
P405 Store locked up.
P501 Dispose of contents/container to an approved waste disposal plant.

Hazards not otherwise classified (HNOC) or not covered by GHS -- none
3. COMPOSITION/INFORMATION ON INGREDIENT (EACH VIAL)

Chemical Name: Copper Indium sulfide/Zinc sulfide  
Chemical Formula: CulnS/ZnS  
Typical Solvents (CAS No): Toluene (108-88-3), Hexanes (110-54-3), Chloroform (67-66-3), Dichloromethane (75-09-2), Methanol (67-56-1), Water

<table>
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<tr>
<th>Substance Name</th>
<th>CAS #</th>
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<tbody>
<tr>
<td>CuS</td>
<td>19138-68-2</td>
</tr>
<tr>
<td>In$_2$S$_3$</td>
<td>12030-24-9</td>
</tr>
<tr>
<td>ZnS</td>
<td>1314-98-3</td>
</tr>
<tr>
<td>Oleylamine</td>
<td>112-90-3</td>
</tr>
<tr>
<td>Oleic Acid</td>
<td>112-90-1</td>
</tr>
<tr>
<td>Toluene</td>
<td>108-88-3</td>
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4. FIRST AID MEASURES

Eye:  
1. Flush immediately with warm water for at least 20 minutes  
2. Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids  
3. If pain persists or recurs seek medical attention  
4. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel

Skin:  
1. Removing contaminated clothing, shoes and leathery wearings  
2. Washing affected area thoroughly with soap and water for at least 20 minutes  
3. Call a physician if irritation develops or persists

Ingestion:  
1. If spontaneous vomiting appears imminent or occurs, hold patient’s head down, lower than their hips to help avoid possible aspiration of vomits  
2. If victim is conscious and alert, give 2-4 cupfuls of milk/water to dilute the substance in the stomach  
3. Never give anything by mouth to an unconscious person  
4. Don’t induce vomiting unless directed to by a medical person  
5. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible, prior to initiating first aid procedures  
6. Seek medical attention

Inhalation  
1. Remove from further exposure and flush thoroughly with air  
2. Lay patient down. Keep warm and rested  
3. Prosthesis such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures  
4. If respiratory irritation seek immediate medical assistance and call a physician

5. FIRE FIGHTING MEASURES

Suitable extinguishing agents: Foam, CO2, dry chemical

Special Hazards:
1. Liquid and vapor are highly flammable
2. Severe fire hazard when exposed to heat, flame and/or oxidizers
3. Vapor may travel a considerable distance to source of ignition
4. Heating may cause expansion and or decomposition leading to violent rupture of containers

**Protective equipment:** Wear self-contained respirator if necessary. Wear protective gloves.

6. **ACCIDENTAL RELEASE MEASURES**

**Person-related safety precautions:** Wear protective equipment. Keep unprotected persons away. Ensure adequate ventilation

**Measures for environmental protection:** Do not allow material to be released to the environment without proper governmental permits.

**Measures for cleaning/collecting:**
1. Remove all ignition sources
2. Clean up all spills immediately
3. Avoid breathing vapors and contact with skin and eyes
4. Control personal contact by using protective equipment
5. Contain and absorb small quantities with vermiculite or other absorbent material
6. Wipe up
7. Collect residues in a flammable waste container

7. **HANDLING AND STORAGE**

**Precautions for safe handling:**
1. Keep container tightly sealed. Store in refrigerator (2-8°C) under dark conditions.
2. Wash thoroughly after handling
3. Use only in well ventilated area
4. Ground and bond containers when transferring
5. Use spark free tools and explosion proof equipment

**Conditions for safe storage, including any incompatibilities**
1. Keep container tightly sealed. Store in refrigerator (2-8°C) under dark conditions.
2. Do not store with acids or oxidizers

8. **EXPOSURE CONTROLS AND PERSONAL PROTECTION**

**Exposure Limits Indium Sulfide Component:**

**Indium (III) sulfide 12030-24-9**
TWA 0.100000 mg/m³ USA. ACGIH Threshold Limit Values (TLV)

**Exposure for Toluene solvent**

OSHA – Final PELs: 200ppm TWA
OSHA Ceiling: 300ppm
ACGIH: 50ppm, skin-potential for cutaneous absorption
NIOSH: 100ppm TWA; 375 mg/m³ TWA; 550ppm IDLH

**Additional information about design of technical systems:** Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute.
General protective and hygienic measures: The usual precautionary measures for handling chemicals should be followed. Keep away from foodstuffs, beverages, and feed. Remove all soiled and contaminated clothing immediately. Wash hands before breaks and at the end of work. Avoid contact with the eyes and skin.

Breathing equipment: Use suitable respirator when high concentrations are present.

Protection of hands: Impervious gloves – check gloves using UV light after use to determine level of contamination.

Eye protection: Safety glasses

Body protection: Protective work clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form: Liquid form - Crystalline powder, dissolved in a solvent

Color: Green to dark red

Odor: Odor dependent upon solvent used. Crystalline powder is odorless

Melting point/Melting range: The solvent is liquid and depends on the chemical composition of the solvent.

Boiling point/Boiling range: Determined by solvent used

Sublimation temperature / start: Not determined

Flash point: Dependent upon solvent used

Ignition temperature: Dependent upon solvent used

Decomposition temperature: Not determined

Danger of explosion: Dependent upon solvent used. Crystalline powder does not present an explosion hazard.

Explosion limits: Currently unknown for nanocrystals

Vapor pressure: Dependent upon solvent used

Solubility in / Miscibility with Polar Solvents: Soluble when hydrophilic ligands are present

Solubility in / Miscibility with Non-Polar Solvents: Soluble when hydrophobic ligands are present

10. STABILITY AND REACTIVITY

Reactivity: Vapor is explosive when exposed to heat or flame

Stability: Stable at room temperature in closed containers under normal storage and handling conditions

Incompatible materials: Heat, flame, strong oxidizers, nitric and sulfuric acids, chlorine, nitrogen tetraoxide; will attack some forms of plastics, rubber, and coatings

Hazardous decomposition products: Carbon monoxide, carbon dioxide, hydrocarbons

Thermal decomposition / conditions to be avoided: Not determined, but temperature increases will affect the solvent used.

Be aware of the necessary warnings for the specific solvent used.

11. TOXICOLOGICAL INFORMATION

Acute toxicity: No data available

Skin corrosion/irritation: No data available

Serious eye damage/eye irritation: No data available

Respiratory or skin sensitization: No data available

Germ cell mutagenicity: No data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.
Reproductive toxicity: Damage to fetus possible Suspected human reproductive toxicant. Reproductive toxicity - Rat - Inhalation Paternal Effects: Spermatogenesis (including genetic material, sperm morphology, motility, and count). Experiments have shown reproductive toxicity effects in male and female laboratory animals.
Developmental Toxicity: Rat - Oral Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus) No data available
Specific target organ toxicity - single exposure Inhalation: May cause respiratory irritation.
Specific target organ toxicity - repeated exposure: No data available
Aspiration hazard: No data available

Additional Information
RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

Do not allow material to be released to the environment without proper governmental permits.

13. DISPOSAL CONSIDERATIONS

Consult local or national regulations for proper disposal.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101
ID Number: UN1294
Hazard class: 3
Packing Group: II
Labeling Requirements: Flammable Liquid
Canadian Transportation of Dangerous Goods: UN1294, Class 3
Land Transport ADR/RID: UN1294, Class 3, Class Code F1, Pack group II
Air Transport IATA/ICAO: UN1294, Class or Division 3, Pack group II
Exceptions: 49 CFR 173.4

15. REGULATIONS

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.
SARA 313 Components
Toluene CAS-No. 108-88-3 Revision Date 2007-07-01
Zinc Sulfide CAS-No. 1314-98-3 Revision Date 2007-01-07
Indium(III) sulfide red CAS-No. 12030-24-9 Revision Date 2007-07-01

Massachusetts Right to Know Components
Toluene CAS-No. 108-88-3 Revision Date 2007-07-01

Pennsylvania Right to Know Components
Indium(III) sulfide red CAS-No. 12030-24-9 Revision Date 2007-07-01
Toluene CAS-No. 108-88-3 Revision Date 2007-07-01
Zinc Sulfide CAS-No. 1314-98-3 Revision Date 2007-01-07
New Jersey Right To Know Components

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California Prop. 65 Components

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm

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16. OTHER INFORMATION

HMIS Rating

Health hazard: 2
Chronic Health Hazard: *
Flammability: 3
Physical Hazard: 0

NFPA Rating

Health hazard: 2
Fire Hazard: 3
Reactivity Hazard: 0