

LTS RESEARCH LABORATORIES, INC.  
MATERIAL SAFETY DATA SHEET  
GALLIUM INDIUM ZINC OXIDE

GENERAL

MANUFACTURER/SUPPLIER: LTS RESEARCH LABORATORIES, INC.

COMPANY'S STREET: 37 RAMLAND ROAD  
COMPANY'S CITY: ORANGEBURG  
COMPANY'S STATE: NEW YORK  
COMPANY'S ZIP CODE: 10962  
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COMPANY'S EMERGENCY TEL. #: 800-424-9300 (LOCAL)  
703-527-3887 (INTERNATIONAL)  
COMPANY'S TEL #: 845-494-2940  
DATE MSDS PREPARED: 02/03/05  
DATE MSDS REVISED: 06/06/11

1. PRODUCT IDENTIFICATION

PRODUCT NAME: GALLIUM INDIUM ZINC OXIDE  
CHEMICAL NATURE: METAL OXIDES  
FORMULA:  $\text{Ga}_2\text{O}_3\text{-In}_2\text{O}_3\text{-ZnO}$  (GIZO or IGZO)  
CAS#: 12024-21-4/1312-43-2/1314-13-2

2. PHYSICAL AND CHEMICAL CHARACTERISTICS

BOILING POINT 760 MM HG: N/A  
MELTING POINT: N/A  
DENSITY @ 20°C: N/A  
VAPOR DENSITY: N/A  
VAPOR PRESSURE (AIR=1): N/A  
SOLUBILITY IN H<sub>2</sub>O: INSOLUBLE  
APPEARANCE AND ODOR: WHITE, YELLOW TO GREEN-YELLOW TARGET, ODORLESS

3. HAZARD IDENTIFICATION

HAZARDOUS COMPONENTS %

GALLIUM OXIDE:  
OSHA/PEL: NO DATA  
ACGIH/TLV: NO DATA  
INDIUM OXIDE: 99.99%  
OSHA/PEL: 0.1 MG/M<sup>3</sup>  
ACGIH/TLV: 0.1 MG/M<sup>3</sup>  
ZINC OXIDE:  
OSHA/PEL: 15 MG/M<sup>3</sup>  
ACGIH/TLV: 10 MG/M<sup>3</sup>  
PROTECTIVE EQUIPMENT: USUAL PRECAUTIONERY MEASURES FOR HANDLING  
CHEMICALS LIKE GLASSES, PROTECTIVE WORK  
CLOTHING SHOULD BE FOLLOWED.

4. FIRE FIGHTING MEASURES

FLASH POINT: NON-FLAMMABLE  
AUTOIGNITION TEMPERATURE: N/A  
FLAMMABLE LIMITS:  
UPPER: N/A  
LOWER: N/A  
EXTINGUISHING MEDIA: SPECIAL POWDER FOR METAL FIRE. DO NOT USE WATER  
SPECIAL FIRE FIGHTING  
PROCEDURES: FIREFIGHTERS MUST WEAR FULL FACE, SELF-CONTAINED  
BREATHING APPARATUS WITH FULL PROTECTIVE  
CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.

UNUSUAL FIRE AND  
EXPLOSION HAZARDS:

FUMES FROM FIRE ARE HAZARDOUS. ISOLATE RUNOFF TO  
PREVENT ENVIRONMENTAL POLLUTION.

TOXIC FUMES OF ZINC OXIDE WHEN HEATED. REACTION  
MAY OCCUR WITH MAGNESIUM, LINSEED OIL, AND  
CHLORINATED RUBBER.

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#### 5. HEALTH HAZARD INFORMATION

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EFFECTS OF EXPOSURE: MAY BE HARMFUL BY INHALATION, INGESTION, OR  
SKIN ABSORPTION. CAUSES EYE AND SKIN IRRITATION.  
MATERIAL IS IRRITATING TO MUCOUS MEMBRANES AND  
UPPER RESPIRATORY TRACT. TO THE BEST OF  
KNOWLEDGE, THE CHEMICAL, PHYSICAL AND  
TOXICOLOGICAL PROPERTIES HAVE NOT  
BEEN THOROUGHLY INVESTIGATED.

INHALATION: MAY CAUSE RESPIRATORY TRACT IRRITATION.  
INGESTION: MAY CAUSE IRRITATION  
.SKIN: MAY CAUSE IRRITATION TO SKIN.  
EYE: MAY CAUSE IRRITATION TO EYES.  
ROUTES OF EXPOSURE: INGESTION, INHALATION, SKIN.EYES  
CARCINOGENITY:  
NTP: NO  
IARC: NO  
OSHA: NO

MEDICAL CONDITIONS  
GENERALLY AGGRAVATED  
BY EXPOSURE: NONE SPECIFIED

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#### 6. STABILITY

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STABILITY: STABLE  
CONDITION TO AVOID: NONE  
INCOMPATIBILITY  
(MATERIAL TO AVOID): ALUMINUM, HEXACHLOROETHANE, CHLORINATED  
RUBBER, LINSEED OIL, MAGMESIUM

HAZARDOUS  
DECOMPOSITION PRODUCTS: METAL OXIDE  
HAZARDOUS  
POLYMERIZATION: WILL NOT OCCUR.

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#### 7. EMERGENCY AND FIRST AID PROCEDURES:

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INHALATION: REMOVE TO FRESH AIR; KEEP WARM AND QUIET; GIVE  
OXYGEN IF BREATHING IS DIFFICULT AND SEEK MEDICAL  
ATTENTION.

INGESTION: PROVIDE 1-2 GLASS OF MILK OR WATER AND INDUCE  
VOMITING IF CONSCIOUS, SEEK IMMEDIATE MEDICAL  
ATTENTION.

SKIN: REMOVE CONTAMINATED CLOTHING, BRUSH MATERIAL  
OFF SKIN, WASH AFFECTED AREA WITH MILD SOAP AND  
WATER, MEDICAL HELP WILL BE NEEDED IF SYMPTOM  
PERSIST.

EYE: RINS EYE FOR SEVERAL MINUTES UNDER RUNNING  
WATER. THEN CONSULT A DOCTOR IF SYMPTOMS  
PERSISTS.

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#### 8. HANDLING AND STORAGE

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HANDLING AND STORAGE WASH THOROUGHLY AFTER HANDLING  
KEEP CONTAINER CLOSED  
STORE IN TIGHTLY CLOSED CONTAINERS IN COOL PLACE  
AWAY FROM THE INCOMPATIBLE MATERIALS.

INCOMPATIBLE PRODUCTS: ACIDS  
PACKAGING: PRODUCT MUST ONLY BE KEPT IN THE SUPPLIER'S  
PACKAGING.  
PACKAGING MATERIALS: PLASTIC MATERIALS (POLYETHYLENE)  
OTHER PRECAUTIONS: NORMAL CHEMICAL HANDLING PROCEDURE

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#### 9. SPILL OR LEAK PROCEDURES

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STEPS TO BE TAKEN IN  
CASE MATERIAL IS  
RELEASED OR SPILLED: SWEEP OR SCOOP UP AND REMOVE.  
RESPIRATORY PROTECTION  
(SPECIFY TYPE): FILTER - DUST, FUME, MIST  
VENTILATION:  
MECHANICAL: NOT RECOMMENDED  
LOCAL: TO MAINTAIN EXPOSURE BELOW TLV.  
PROTECTIVE GLOVES: GLOVES  
EYE PROTECTION: SAFETY GLASSES.  
PROTECTIVE CLOTHING: PROTECTIVE WORK CLOTHING TO PREVENT  
CONTAMINATION SKIN AND CLOTHING.  
WASTE DISPOSAL METHOD:  
REGULATIONS. IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL

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#### 10. TOXICITY DATA

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TO THE BEST OF OUR KNOWLEDGE, ACUTE AND CHRONIC TOXICITY OF INDIUM ZINC OXIDE IS NOT FULLY KNOWN. NO CLASSIFICATION DATA ON CARCINOGENIC PROPERTIES IS AVAILABLE FROM IARC, NTP OR OSHA. NO SENSITIZATION RECORDED.

ACUTE TOXICITY (Ga<sub>2</sub>O<sub>3</sub>): LD 50 ORAL (RAT): 10000 MG/KG (PUBLISH DATA)  
LOCAL EFFECTS: SLIGHTLY IRRITATING TO THE EYES.

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#### 11. TRANSPORTATION DATA

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NOT REGULATED  
UN#: N/A  
HAZARD CLASS: NONE  
ADR//RID CLASS: NOT RESTRICTED  
IMDG CLASS: NOT RESTRICTED  
AIR TRAN. ICAO/IATA CLASS: NOT RESTRICTED  
MARITIME TRAN. IMDG CLASS: NOT RESTRICTED

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#### 12. OTHER INFORMATION

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THIS SAFETY DATA SHEET SHOULD BE USED IN CONJUNCTION WITH TECHNICAL SHEETS. IT DOES NOT REPLACE THEM. THE INFORMATION GIVEN IS BASED ON OUR KNOWLEDGE OF THIS PRODUCT, AT THE TIME OF PUBLICATION. IT IS GIVEN IN GOOD FAITH. THE ATTENTION OF THE USER IS DRAWN TO THE POSSIBLE RISKS INCURRED BY USING THE PRODUCT FOR ANY OTHER PURPOSE OTHER THAN THAT FOR WHICH IT WAS INTENDED. THIS DOES NOT IN ANY WAY EXCUSE THE USER FROM KNOWING AND APPLYING ALL THE REGULATIONS GOVERNING HIS ACTIVITY. IT IS THE SOLE RESPONSIBILITY OF THE USER TO TAKE ALL PRECAUTIONS REQUIRED IN HANDLING THE PRODUCT. THE AIM OF THE MANDATORY REGULATIONS MENTIONED IS TO HELP THE USER TO FULFILL HIS OBLIGATIONS REGARDING THE USE OF HAZARDOUS PRODUCTS.