1. IDENTIFICATION

Product Identifier
Product Name
LSM Based Ink

Other means of identification
SDS #
NT-029

Synonyms
LSM-I; LSMYSZ-I; Lanthanum Strontium Manganese - Yttria Stabilized Zirconia Ink.

Recommended use of the chemical and restrictions on use
Recommended Use
Laboratory chemicals and Manufacture of substances.

Details of the supplier of the safety data sheet
Supplier Address
Nexceris, LLC
404 Enterprise Dr.
Lewis Center, OH 43035
www.nexceris.com

Emergency Telephone Number
Company Phone Number
Non-emergency calls/questions: 1-614-842-6606
Fax: 1-614-842-6607
Emergency Telephone (24 hr)
INFOTRAC 1-352-323-3500 (International)
1-800-535-5053 (North America)

2. HAZARDS IDENTIFICATION

Appearance
Black liquid

Physical state
Liquid

Classification

<table>
<thead>
<tr>
<th>Condition</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin corrosion/irritation</td>
<td>Category 2</td>
</tr>
<tr>
<td>Serious eye damage/eye irritation</td>
<td>Category 2</td>
</tr>
<tr>
<td>Skin sensitization</td>
<td>Category 1</td>
</tr>
</tbody>
</table>

Signal Word
Warning

Hazard statements
Causes skin irritation
Causes serious eye irritation
May cause an allergic skin reaction
**Precautionary Statements - Prevention**
Wash face, hands and any exposed skin thoroughly after handling
Avoid breathing dust/fume/gas/mist/vapors/spray
Contaminated work clothing must not be allowed out of the workplace
Wear protective gloves/eye protection/face protection

**Precautionary Statements - Response**
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
IF ON SKIN: Wash with plenty of water and soap
Take off contaminated clothing and wash it before reuse
If skin irritation or rash occurs: Get medical advice/attention

**Precautionary Statements - Disposal**
Dispose of contents/container to an approved waste disposal plant

**Other hazards**
Toxic to aquatic life with long lasting effects

### 3. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Synonyms</th>
<th>LSM-I; LSMYSZ-I; Lanthanum Strontium Manganite - Yttria Stabilized Zirconia Ink.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemical Name</strong></td>
<td><strong>CAS No.</strong></td>
</tr>
<tr>
<td>Lanthanum oxide</td>
<td>1312-81-8</td>
</tr>
<tr>
<td>Zirconium oxide</td>
<td>1314-23-4</td>
</tr>
<tr>
<td>Terpineol</td>
<td>8000-41-7</td>
</tr>
<tr>
<td>Manganese oxide</td>
<td>1317-35-7</td>
</tr>
<tr>
<td>Strontium oxide</td>
<td>1314-11-0</td>
</tr>
<tr>
<td>Yttrium Oxide</td>
<td>1314-36-9</td>
</tr>
<tr>
<td>Hafnium Oxide</td>
<td>12055-23-1</td>
</tr>
</tbody>
</table>

*If Chemical Name/CAS No is "proprietary" and/or Weight-% is listed as a range, the specific chemical identity and/or percentage of composition has been withheld as a trade secret.*

### 4. FIRST AID MEASURES

**First Aid Measures**

**General Advice**
If exposed or concerned: Get medical advice/attention.

**Eye Contact**
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**Skin Contact**
IF ON SKIN: Wash with plenty of water and soap. Take off contaminated clothing and wash it before reuse. If skin irritation or rash occurs: Get medical advice/attention.

**Inhalation**
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Seek medical attention for further treatment.

**Ingestion**
IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Seek medical attention if symptoms develop.

**Most important symptoms and effects**

**Symptoms**
Causes skin irritation. Causes serious eye irritation. May cause an allergic skin reaction.
Indication of any immediate medical attention and special treatment needed

Notes to Physician
Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media
Not determined.

Specific Hazards Arising from the Chemical
Not determined.

Protective equipment and precautions for firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions
Use personal protective equipment as required.

Environmental precautions

Environmental precautions
Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

Methods and material for containment and cleaning up

Methods for Containment
Prevent further leakage or spillage if safe to do so.

Methods for Clean-Up
Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on Safe Handling
Handle in accordance with good industrial hygiene and safety practice. Wash face, hands and any exposed skin thoroughly after handling. Avoid breathing dust/fume/gas/mist/vapors/spray. Contaminated work clothing must not be allowed out of the workplace. Wear protective gloves/eye protection/face protection.

Conditions for safe storage, including any incompatibilities

Storage Conditions
Keep containers tightly closed in a dry, cool and well-ventilated place.

Incompatible Materials
None known based on information supplied.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Guidelines

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
<th>NIOSH IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zirconium Oxide</td>
<td>STEL: 10 mg/m³ Zr TWA: 5 mg/m³ Zr</td>
<td>TWA: 5 mg/m³ Zr (vacated) STEL: 10 mg/m³ Zr</td>
<td>IDLH: 25 mg/m³ Zr TWA: 5 mg/m³ except Zirconium tetrachloride Zr STEL: 10 mg/m³ Zr</td>
</tr>
</tbody>
</table>
Manganese oxide
1317-35-7
TWA: 0.02 mg/m³ Mn respirable particulate matter
TWA: 0.1 mg/m³ Mn inhalable particulate matter
(vacated) TWA: 1 mg/m³ Mn
(vacated) Ceiling: 5 mg/m³ Mn
IDLH: 500 mg/m³ Mn
STEL: 3 mg/m³ Mn

Yttrium Oxide
1314-36-9
TWA: 1 mg/m³ Y
IDLH: 500 mg/m³ Y

Hafnium Oxide
12055-23-1
TWA: 0.5 mg/m³ Hf
IDLH: 50 mg/m³ Hf

**Appropriate engineering controls**

**Engineering Controls**
Apply technical measures to comply with the occupational exposure limits. Eyewash stations. Showers.

**Individual protection measures, such as personal protective equipment**

**Eye/Face Protection**
Refer to 29 CFR 1910.133 for eye and face protection regulations.

**Skin and Body Protection**
Refer to 29 CFR 1910.138 for appropriate skin and body protection.

**Respiratory Protection**
Ensure adequate ventilation, especially in confined areas. Refer to 29 CFR 1910.134 for respiratory protection requirements.

**General Hygiene Considerations**
Handle in accordance with good industrial hygiene and safety practice.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

**Information on basic physical and chemical properties**

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical state</td>
<td>Liquid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appearance</td>
<td>Black liquid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td>Black</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Odor</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melting Point-Freezing Point</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boiling Point/Boiling Range</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flash Point</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammability (Solid, Gas)</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammability Limits in Air</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Flammability Limits</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Flammability Limit</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vapor Density</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative Density</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Solubility</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partition Coefficient</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auto-ignition Temperature</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kinematic Viscosity</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic Viscosity</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>Not determined</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 10. STABILITY AND REACTIVITY

**Reactivity**
Not reactive under normal conditions.
Chemical Stability
Stable under recommended storage conditions.

Possibility of Hazardous Reactions
None under normal processing.

Conditions to Avoid
Keep out of reach of children.

Incompatible Materials
None known based on information supplied.

Hazardous Decomposition Products
None known based on information supplied.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information

Eye Contact Causes serious eye irritation.

Skin Contact Causes skin irritation.

Inhalation Do not inhale.

Ingestion Do not ingest.

Component Information

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Oral LD50</th>
<th>Dermal LD50</th>
<th>Inhalation LC50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lanthanum oxide</td>
<td>&gt; 8500 mg/kg (Rat)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1312-81-8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terpineol</td>
<td>= 2900 mg/kg (Rat)</td>
<td>&gt; 3000 mg/kg (Rabbit)</td>
<td>-</td>
</tr>
<tr>
<td>8000-41-7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Information on physical, chemical and toxicological effects

Symptoms Please see section 4 of this SDS for symptoms.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Carcinogenicity Based on the information provided, this product does not contain any carcinogens or potential carcinogens as listed by OSHA, IARC or NTP.

Numerical measures of toxicity

The following values are calculated based on chapter 3.1 of the GHS document.

ATEmix (oral) 2,864.00 mg/kg
ATEmix (dermal) 2,485.00 mg/kg

12. ECOLOGICAL INFORMATION

Ecotoxicity Toxic to aquatic life with long lasting effects.
Persistence/Degradability
Not determined.

Bioaccumulation
Not determined.

Mobility
Not determined

Other Adverse Effects
Not determined

13. DISPOSAL CONSIDERATIONS

Waste Treatment Methods

Disposal of Wastes
Disposal should be in accordance with applicable regional, national and local laws and regulations.

Contaminated Packaging
Disposal should be in accordance with applicable regional, national and local laws and regulations.

14. TRANSPORT INFORMATION

Note
Please see current shipping paper for most up to date shipping information, including exemptions and special circumstances.

DOT
Not regulated

IATA
Not regulated

IMDG
Marine Pollutant
Yes

15. REGULATORY INFORMATION

International Inventories

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>TSCA</th>
<th>DSL/NDSL</th>
<th>EINECS/ELINCS</th>
<th>ENCS</th>
<th>IECSC</th>
<th>KECL</th>
<th>PICCS</th>
<th>AICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lanthanum oxide</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Present</td>
<td>X</td>
<td>Present</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Zirconium Oxide</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Present</td>
<td>X</td>
<td>Present</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Terpineol</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Present</td>
<td>X</td>
<td>Present</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Manganese oxide</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Present</td>
<td>X</td>
<td>Present</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Strontium oxide</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Present</td>
<td>X</td>
<td>Present</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Yttrium Oxide</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Present</td>
<td>X</td>
<td>Present</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hafnium Oxide</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Present</td>
<td>X</td>
<td>Present</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances
US Federal Regulations

CERCLA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355).

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS No.</th>
<th>Weight-%</th>
<th>SARA 313 - Threshold Values %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manganese oxide - 1317-35-7</td>
<td>1317-35-7</td>
<td>7-25</td>
<td>1.0</td>
</tr>
</tbody>
</table>

CWA (Clean Water Act)
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

US State Regulations

California Proposition 65
This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>New Jersey</th>
<th>Massachusetts</th>
<th>Pennsylvania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zirconium Oxide</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>1314-23-4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manganese oxide</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>1317-35-7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

16. OTHER INFORMATION

NFPA
Health Hazards: Not determined
Flammability: Not determined
Instability: Not determined
Special Hazards: Not determined

HMIS
Health Hazards: Not determined
Flammability: Not determined
Physical hazards: Not determined
Personal Protection: Not determined

Issue Date: 23-Jan-2018
Revision Date: 24-Jan-2018
Revision Note: New format

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet