PRODUCT NAME: JSR ARF AM 2073J-19

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION
Product Identifier: JSR ARF AM 2073J-19
General Use: Photoresist for Integrated Circuit Production
Product Description: Photoacid generator and Poly(meth)acrylate polymer solution

MANUFACTURER: JSR Micro, Inc.
1280 North Mathilda Ave., Sunnyvale, CA 94089
Telephone: 408-543-8800
CHEMTREC: 1-800-424-9300

2. COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>%</th>
<th>CAS #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorinated poly(meth)acrylate (FARM)</td>
<td>5-25 Proprietary</td>
</tr>
<tr>
<td>Alicyclic carboxylic ester</td>
<td>0-5 Proprietary</td>
</tr>
<tr>
<td>Photoacid Generator</td>
<td>0.1-3 Proprietary</td>
</tr>
<tr>
<td>Propylene glycol monomethyl ether acetate (PGMEA)</td>
<td>80-95 108-65-6</td>
</tr>
</tbody>
</table>

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:
Transparent liquid with a ketone-like odor.

POTENTIAL HEALTH EFFECTS

INHALATION:
May cause irritation to nose, throat and anesthesia.

EYE CONTACT:
Eye contact may cause irritation and corneal injury.

SKIN CONTACT:
Prolonged and repeated contact with skin may cause irritation and dermatitis.

INGESTION:
Swallowing may nauseate and cause pain in esophagus and stomach.

CARCINOGENICITY:

SOLVENT(PGMEA)
NTP: No, IARC MONOGRAPHS:NO, OSHA Regulated: No

FARM
NTP: No, IARC MONOGRAPHS:NO, OSHA Regulated: No

Alicyclic carboxylic ester
NTP: No, IARC MONOGRAPHS:NO, OSHA Regulated: No

Photoacid Generator
NTP: No, IARC MONOGRAPHS:NO, OSHA Regulated: No

SIGNS AND SYMPTOMS:
Eye and skin irritation, nausea, pain in esophagus, stomach, and anesthesia.

NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=2 REACTIVITY=0

4. FIRST AID MEASURES

INHALATION:
PRODUCT NAME: JSR ARF AM 2073J-19

Remove exposed person to fresh air; perform artificial respiration if necessary.

EYE CONTACT:
Immediately flush eyes with plenty of water at least 15 min. Call a physician.

SKIN CONTACT:
Flush skin with water and soap.

INGESTION:
Give large quantities of water, contact a poison center and call physician immediately.

NOTE TO PHYSICIAN:
Treatment may vary with condition of victim and specifics of incident.

5. FIRE-FIGHTING MEASURES
GENERAL HAZARD:
Combustible liquid. May release vapors that form flammable mixtures when temperatures are at or above the flash point. Toxic gases will form upon combustion.

EXTINGUISHING MEDIA:
Carbon dioxide, alcohol foam or dry chemical.

SPECIAL FIRE FIGHTING PROCEDURES:
Water should be used to keep fire exposed containers cool and to dispense vapors. Firefighters should wear self-contained breathing apparatus.

FIRE AND EXPLOSION HAZARDS:
Combustible liquid. Toxic gases, smoke, and oxides of Carbon will form upon combustion.

6. ACCIDENTAL RELEASE MEASURES
DO NOT RELEASE INTO THE ENVIRONMENT
LARGE SPILL/SMALL SPILL:
For indoor spills, provide increased ventilation as required to minimize exposure. Cleanup the spill as indicated in the appropriate land or water section below. Dispose of absorbent and other waste in an appropriate chemical waste container. Wear proper personal protective equipment. Wash thoroughly after handling.

LAND SPILL:
Sweep spilled material and transfer to D.O.T. container for disposal. Avoid raising dust.

WATER SPILL:
Do not allow release to water. Remove from water by skimming.

7. HANDLING AND STORAGE
GENERAL:
Store in original container in a dry area. Avoid heat, sunlight, and ignition sources. Open only under safe light and well ventilated conditions. Loosen closure cautiously before opening. When using this substance: (a) avoid breathing the substance; (b) avoid ingestion; (c) use respiratory protection when in dust or mist form. Wear chemical goggles, resistant gloves and protective clothing to prevent contact. Wash thoroughly after handling.

STORAGE TEMPERATURE: 32~50°F (0~10°C)
STORAGE PRESSURE: Atmospheric

8. EXPOSURE CONTROLS/PERSONAL PROTECTION
ENGINEERING CONTROLS:
PRODUCT NAME: **JSR ARF AM 2073J-19**

The use of local exhaust ventilation is recommended to control emissions near the source. Laboratory samples should be handled in a fume hood. Provide mechanical ventilation of confined spaces. Use explosion-proof ventilation equipment.

**PERSONAL PROTECTION**

**RESPIRATORY PROTECTION:**
Under conditions of frequent use or heavy exposure, Respiratory protection may be needed. Respiratory protection is ranked in order from minimum to maximum. Consider warning properties before use. NIOSH approved respirators as follows:
- Any chemical cartridge respirator with organic vapor cartridge(s).
- Any chemical cartridge respirator with a full facepiece and organic Vapor cartridge(s).
- Any air-purifying respirator with a full facepiece and an organic Vapor canister.
For Unknown Concentrations or Immediately Dangerous to Life or Health.
- Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.
- Any self-contained breathing apparatus with a full facepiece.

**SKIN PROTECTION:**
Wear impermeable gloves and clothing during activities where there is potential for direct skin contact with chemical.

**EYE PROTECTION:**
Wear primary eye protection such as splash resistant safety goggles with a secondary protection faceshield. Provide an emergency eye wash station and quick drench shower in the immediate work area.

**EXPOSURE GUIDELINE (S):**

**OSHA HAZARDS (29 CFR 1910.1200) Exposure Limits 8 hrs. TWA (ppm)**

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>OSHA PEL</th>
<th>ACGIH TLV</th>
</tr>
</thead>
<tbody>
<tr>
<td>FARM</td>
<td>not established</td>
<td>not established</td>
</tr>
<tr>
<td>Alicyclic carboxylic ester</td>
<td>not established</td>
<td>not established</td>
</tr>
<tr>
<td>Photoacid Generator</td>
<td>not established</td>
<td>not established</td>
</tr>
<tr>
<td>PGMEA</td>
<td>100 ppm*</td>
<td>not established</td>
</tr>
</tbody>
</table>

*Denotes Cal-OSHA Standard

**9. PHYSICAL AND CHEMICAL PROPERTIES**
- Vapor Pressure: 2 mmHg at 20°C
- Specific Gravity: 1.0 ~ 1.1
- Solubility in water: Poor
- Boiling Point: 146°C
- Flashpoint and Method: 42°C
- Flammable Limits: LFL; 1.5% UFL; 7.0%
- Autoignition: 354°C
10. STABILITY AND REACTIVITY

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID)
Strong oxidizing agents, strong acids, strong bases.

STABILITY: (CONDITIONS TO AVOID)
Materials containing similar structural groups are normally stable. This material maybe sensitive to peroxide formation.

HAZARDOUS DECOMPOSITION PRODUCTS:
Combustion will produce toxic vapors and gases.

HAZARDOUS POLYMERIZATION:
May not occur.

11. TOXICOLOGICAL INFORMATION

SOLVENT (PGMEA)

ACUTE TOXICITY

<table>
<thead>
<tr>
<th></th>
<th>Oral LD50</th>
<th>Dermal LD50</th>
<th>Rat</th>
<th>Rabbit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8,532mg/kg</td>
<td>&gt; 5g/kg</td>
<td></td>
<td></td>
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</table>

Photoacid Generator 1:

ACUTE TOXICITY

<table>
<thead>
<tr>
<th></th>
<th>Oral LD50</th>
<th>Rat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,500mg/kg</td>
<td></td>
</tr>
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</table>

MUTAGENICITY

<table>
<thead>
<tr>
<th></th>
<th>Ames test:</th>
<th>Chromosomal aberration test:</th>
<th>Micronucleus test:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Negative</td>
<td>Negative</td>
</tr>
</tbody>
</table>

Photoacid Generator 2:

ACUTE TOXICITY

<table>
<thead>
<tr>
<th></th>
<th>Oral LD50</th>
<th>Rat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>200-300mg/kg</td>
<td></td>
</tr>
</tbody>
</table>

MUTAGENICITY

<table>
<thead>
<tr>
<th></th>
<th>Ames test:</th>
<th>Chromosomal aberration test:</th>
<th>Micronucleus test:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Negative</td>
<td>Negative</td>
</tr>
</tbody>
</table>

Photoacid Generator 3:

ACUTE TOXICITY

<table>
<thead>
<tr>
<th></th>
<th>Oral LD50</th>
<th>Rat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,500mg/kg</td>
<td></td>
</tr>
</tbody>
</table>

MUTAGENICITY

<table>
<thead>
<tr>
<th></th>
<th>Ames test:</th>
<th>Chromosomal aberration test:</th>
<th>Micronucleus test:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Negative</td>
<td>Negative</td>
</tr>
</tbody>
</table>

FARM: No information available
Alicyclic carboxylic ester: No information available

12. ECOLOGICAL INFORMATION

Biodegradation

SOLVENT: PGMEA

100% degradable after 8 days.
5000 ug/L 24 year (Stress) Sea Lamprey (Petromyzon marinus)

FARM: No information available
PRODUCT NAME: **JSR ARF AM 2073J-19**

Alicyclic carboxylic ester: No information available  
Photoacid Generator: No information available

13. DISPOSAL CONSIDERATION

**DO NOT RELEASE INTO THE ENVIRONMENT**

The user of this product must properly characterize the waste generated from the use of this product in accordance with all applicable federal, state and/or local laws and regulations in order to determine the proper disposal of the waste in accordance with all applicable federal, state and/or local laws and regulations.

14. TRANSPORT INFORMATION

**TRANSPORTATION AND HAZARDOUS MATERIALS DESCRIPTION:**

Package and transport in accordance with Department of Transportation (DOT) and other regulatory agency requirements.

<table>
<thead>
<tr>
<th>U. S. DOT PROPER SHIPPING NAME:</th>
<th>Resin solution, 3, UN1866, III</th>
</tr>
</thead>
<tbody>
<tr>
<td>IATA PROPER SHIPPING NAME:</td>
<td>Resin solution</td>
</tr>
<tr>
<td>IDENTIFICATION NUMBER:</td>
<td>UN 1866</td>
</tr>
</tbody>
</table>

15. REGULATORY INFORMATION

**OSHA HAZARD COMMUNICATION STANDARD, 29 CFR 1910.1200:** Ensure that the hazards associated with this product are transmitted to employees by means of a hazard communications program, in accordance with federal and state Occupational Safety and Health Administration (OSHA) regulations.

**CERCLA/SUPERFUND HAZARD CATEGORY:** At the time of this document's preparation, none of the ingredients of this product were listed in 40 CFR 302.4. The list should be periodically checked for applicable updates.

**SARA 313 INFORMATION:** At the time of this document's preparation, none of the ingredients of this product were listed in 40 CFR 372. The list should be periodically checked for applicable updates.

**TOXIC SUBSTANCES CONTROL ACT (TSCA):** All of the compounds in this product are on the TSCA Inventory and/or are subject to a Low Volume Exemption. In accordance with federal regulations, this Photoresist shall be used only to manufacture integrated circuits. In particular, this material shall not be distributed to any person, other than for disposal, until after it has been completely reacted on integrated circuits or similar media. All users must utilize the worker protection measures and environmental release controls specified in this Material Safety Data Sheet and in EPA and OSHA regulations. Acknowledgement of receipt of this Material Safety Data Sheet shall be considered acknowledgement that the user will comply with these requirements.

**CALIFORNIA PROPOSITION 65 WARNING:** At the time of this document's preparation, one or more constituents of this product were included on the Proposition 65 list of chemicals known to cause cancer and birth defects or other reproductive harm. The list should be periodically checked for applicable updates.

16. OTHER INFORMATION

**REVISION SUMMARY**

- July 8, 2004: Original MSDS established.
- September 23, 2004: Revision 1 established.
- May 31, 2005: Revision 2 established.
PRODUCT NAME: **JSR ARF AM 2073J-19**

November 23, 2005    Revision 3 established.
June 9, 2006        Revision 4 established.
April 15, 2009      Revision 5 established.

To the best of our knowledge, the information contained herein is accurate. However, neither JSR Corporation nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards, which exist.