HD MicroSystems™
An Enterprise of Hitachi Chemical and DuPont Electronics

MATERIAL SAFETY DATA SHEET

***** IDENTIFICATION *****

NAME: PI2808 SYNONYMS: POLYIMIDE COATING.
CHEM.FAMILY: Pyralin(R) Polyimide Coating. FORMULA: Proprietary.

MANUFACTURER:
HD MicroSystems [TM]
Cheesequake Road
Parlin, NJ 08859

INFORMATION & EMERGENCY TELEPHONE NOS:
INFORMATION: Product: (800)441-7515
EMERGENCIES: Medical: (800)441-3637
Transport (CHEMTREC): (800)424-9300

All Ingredients in This Product are TSCA Listed/Reported.

***** PHYSICAL DATA *****

FORM: Viscous Liquid. ODOR: Aromatic.

APPEARANCE: Colorless to Amber. SOLUBILITY IN WATER: Slight.

***** COMPONENTS *****

Material(s):	CAS#	V.P. mm Hg @ 20C	Weight %
Water.	7732-18-5	< 20.	.1 - 1%
N-Methyl-2-Pyrollidone.	872-50-4	< 1.	> 60%
4,4'-Oxydianiline.	101-80-4		5 - 10%
Pyromellitic Dianhydride.	89-32-7		5 - 10%

***** HAZARDOUS REACTIVITY *****

INSTABILITY:
The product is normally stable.

INCOMPATIBILITY:
Avoid contact with: Water; Oxidizable materials; Oxygen; Strong acids; Peroxides; Strong reducing agents; Strong oxidizing agents; Strong alkalies.

DECOMPOSITION:
Decomposition products: Carbon Dioxide (CO2); Various hydrocarbons; Carbon Monoxide (CO); Carbon monoxide, carbon dioxide, water; Carbon oxides; Nitrogen oxides.

POLYMERIZATION: Hazardous polymerization will not occur.

***** FIRE & EXPLOSION DATA *****

FLASHPOINT: 204 F Closed cup

FIRE & EXPLOSION HAZARDS:
The product is not an unusual fire or explosion hazard.

EXTINGUISHING MEDIA:
Sand, dry chemical, or carbon dioxide.

SPECIAL FIREFIGHTING INFORMATION:
Toxic decomposition products may form under fire conditions. (See Decomposition Section.); Wear full protective clothing and a full facepiece, positive pressure, self-contained breathing apparatus (SCBA); Decontaminate contaminated clothing and equipment with soap and water. Dispose of residues per federal, state, and local regulation. (See Waste Disposal Section.).

***** HEALTH HAZARD INFORMATION *****

OVERVIEW: The most likely routes of worker overexposure to this product are skin contact and inhalation. Skin irritation and / or other effects of skin contact are easily avoided by: using proper gloves, reading "Protection Information" section below; not touching exposed skin (like your neck or face) or clothing with contaminated gloves; using proper glove removal techniques; washing affected areas immediately if skin contact occurs; washing hands before leaving the work area. Inhalation exposure would occur by breathing the product's volatile components, which begin to evaporate at room temperature when product container is opened. Volatile solvents continue to evaporate during room temperature use of the prouct, such as pouring from the jar to the dispensing machine and spin coating. Mist and solvent vapors will evolve if a spray application is used. During the wafer or substrate drying (125 - 150 deg C) and the final curing (300 - 450 deg C) any remaining solvent shall volatilize. Consideration should be given to avoiding overexposure to chemicals used in related processes. For example, avoid over exposure to chemicals used as "product thinners", solvents used to clean process equipment, and other chemicals used in the operation such as wafer etchants and parts cleaners. Personnel performing maintenance and repairs on dispensing

equipment (e.g. spin coaters) may need personnel protective equipment such as respirators, gloves, goggles, and protective clothing to prevent exposure to accumulated materials. Well-designed area and personal air sampling /analysis can show whether exposures are within the required / recommended limits. Properly designed engineering controls such as local ventilation and process enclosures are effective ways to reduce the environmental concentrations to permissible limits. Respirators should be used when engineering and work practice controls are not technically feasible, or when such controls are in the process of being installed, or when the engineering controls fail and need to be supplemented. (See the "Exposure Limits" table below for more information). Process controls and procedures must comply with all applicable Federal, State (or Provincial) and Local safety, health and environmental laws, regulations and ordinances. In addition, it is always prudent to use all the practical means to limit worker exposure to chemicals. Significant differences in overall exposure can be made by using practical measures such as:

- Inhalation - Minimize exposure by keeping containers of product, solvents, solvent-dampened clean wipes, etc, covered;
- Skin - Avoid contact by selecting proper gloves, and know how to them properly;
- Eye - Wear chemical safety glasses when handling the product, solvents and waste materials, and where there is potential for splashing wear chemical goggles and face shield;
- Ingestion - Avoid inadvertent ingestion by washing the hands before eating, drinking, or smoking, and restrict these activities to locations outside of the work area.

PRINCIPAL HEALTH EFFECTS:

Water
Human health effects of overexposure may include: BY CONTACT, INHALATION, OR INGESTION: Not considered to be hazardous.

N-Methyl-2-Pyrollidone
Toxic effects described in animals include: BY SKIN CONTACT: No skin sensitization; BY INHALATION: Altered respiratory rate; Nonspecific effects, e.g., weight loss and irritation. Toxic effects of repeated or prolonged animal exposures include: BY INHALATION: Lethargy/inactivity; Weight loss; Bone marrow effects; Increased mortality; Testicular effects; BY INGESTION: Decreased body weight; Blood effects; Kidney tissue degeneration; Altered enzyme activity; Thyroid effects; Additional animal tests have shown: NMP is not carcinogenic when tested by the inhalation, skin, and "under skin" routes of administration on laboratory animals. In oral studies, NMP was not carcinogenic in rats, but produced liver tumors in mice. There was no clear dose-response relationship in the mouse study and the significance of the data is unknown. == NMP was not teratogenic (i.e. did not cause fetal developmental malformations) by skin exposure to laboratory test animals. For inhalation animal testing, NMP showed developmental delays rather than teratogenic effects. The delayed effects involved a reduction in fetal body weight, delay in physical development and limited evidence of deficits in behavioral test. The effects were found to be neither permanent nor life-threatening. == Tests have shown that NMP does not cause genetic damage in bacterial or mammalian cell cultures. It has not been tested in animals for genetic toxicity. ****Human health effects of overexposure may include: BY SKIN CONTACT: Dermatitis; Skin irritation with itching, burning, redness, swelling or rash; BY EYE CONTACT: Eye irritation

with discomfort, tearing, or blurring of vision; BY INHALATION: Vapors may cause respiratory tract irritation; May cause nose and throat irritation with sneezing, sore throat or runny nose; Nonspecific discomfort, e.g., nausea, headache or weakness; BY INGESTION: Chills; May cause gastrointestinal tract irritation; Vomiting; Abdominal cramps; BY INHALATION OR INGESTION: Drowsiness; Nausea; Dizziness. Human effects of higher level acute, repeated or chronic overexposure may include: BY SKIN CONTACT: There are inconclusive or unverified reports of human sensitization; Rash; Blisters; Burning; Cracking; Redness; Pain; Severe irritation; Skin permeation may occur in amounts capable of producing the effects of systemic toxicity. ***In addition: No information was found to determine carcinogenic potential of NMP in humans. == One documented human case has attempted to link human stillbirth and occupational NMP exposure. This study neither proved nor disproved a causal link between the NMP exposure and the stillbirth. == There are reports that low NMP exposures caused some individuals to experience eye irritation or chronic headache.

4,4'-Oxydianiline
Toxic effects described in animals include: BY SKIN CONTACT: Skin sensitization; No skin irritation; BY INGESTION: Hair loss. Toxic effects of repeated or prolonged animal exposures include: BY INGESTION: Jaundice; Pituitary hyperplasia; Cataract formation; Testicular effects; Gastrointestinal effects; ****Additional animal tests have shown: Not tested for heritable genetic damage; No genetic damage in animals; Genetic damage in bacterial and mammalian cell cultures; Reproductive toxicity at dose levels showing other toxic effects; No animal data available to define developmental toxicity; BY INGESTION: Oxydianiline (ODA) is carcinogenic in the rat and mouse producing testicular, uterine, liver and thyroid tumors in rats and harderian gland, liver and thyroid tumors in mice; Damage to retina, blindness. Human health effects of overexposure may include: BY SKIN CONTACT: Allergic skin rashes; There are no reports of human sensitization; BY EYE CONTACT: Eye irritation with discomfort, tearing, or blurring of vision; BY INGESTION: Reduction of the blood's oxygen-carrying capacity with cyanosis (bluish discoloration), weakness or shortness of breath by formation of cyanmethemoglobin. In addition: Based on animal studies, DuPont has categorized ODA as a probable human carcinogen. ODA is not likely to be a human reproductive toxin. DuPont has established acceptable exposure limits (see table below) to protect against potential toxic effects of ODA.

Pyromellitic Dianhydride
Toxic effects described in animals include: BY SKIN CONTACT: Severe skin irritation; BY INHALATION: Respiratory effects; BY INGESTION: Kidney damage; Inflammation; Weight loss. Toxic effects of repeated or prolonged animal exposures include: BY SKIN CONTACT: Dermatitis; BY INHALATION: Pulmonary effects; Reduced weight gain; Liver damage; Kidney damage; Spleen effects; ****Additional animal tests have shown: Not tested for genetic toxicity in mammalian cell cultures or animals; No genetic damage in bacterial cell cultures; No animal test reports are available to define carcinogenic, developmental, or reproductive hazards. Human health effects of overexposure may include: BY SKIN CONTACT: Allergic reaction; Skin irritation with itching, burning, redness, swelling or rash; Sensitization; BY EYE CONTACT: Eye irritation with discomfort, tearing, or blurring of vision; BY INHALATION: Irritation of the nose and throat; Temporary lung irritation effects with cough, discomfort, difficulty breathing or shortness of breath. Human effects of higher level acute, repeated or chronic overexposure may include: BY INHALATION: Respiratory sensitization (asthma); Asthma-like reactions with shortness of breath, wheezing or cough, and possibly occurring on subsequent re-exposure to concentrations below established exposure limits.

Individuals may have increased susceptibility to the hazards of overexposure to ingredient(s) of this product if they have pre-existing diseases of the: Skin; Eyes; Lungs; Thyroid; Liver.

ANIMAL DATA:

N-Methyl-2-Pyrollidone
Inhalation 4 hour ALC [Rats]: 1.7 mg/L
Skin LD50 [Rabbits]: 8000 mg/kg
Oral LD50 [Rats]: 4320 mg/kg.

4,4'-Oxydianiline
Skin ALD [Rabbits]: >5,000 mg/kg
Oral LD50 [Rats]: 725 mg/kg
Oral LD50 [Mouse]: 685 mg/kg
Oral LD50 [Rabbit]: 700 mg/kg
Oral LD50 [Guinea pig]: 650 mg/kg.

Pyromellitic Dianhydride
Inhalation 6 Hr ALC [Rats]: 0.5 mg/L
Inhalation 4 Hr LCLo [Rats]: 150 mg/m3
Oral LD50 [Mice]: 2400 mg/kg
Oral LD50 [Rats]: 2250 mg/kg.

CARCINOGENICITY LISTING:

The following ingredients are listed as potential carcinogens:

INGREDIENT	ACGIH	IARC	NTP	OSHA	DUPONT
4,4'-Oxydianiline		X	X		X

EXPOSURE LIMITS:
Workplace exposures should be kept below the following limits:

.	AIHA		ACGIH		OSHA	
Name/Units	8hr	15min	8hr	15min	8hr	15min
N-METHYL-2-PYRROLIDONE						
Units: ppm	10	(S)				
PARTICULATES (N.O.S.), respirable						
Units: mg/m3			3		5	
PARTICULATES (N.O.S.), total dust						
Units: mg/m3			10		15	

Also, DuPont has established and observes the following limits:

Name/Units	12 hr	8hr	15min	Ceiling
N-METHYL-2-PYRROLIDONE				
Units: ppm	5	5		(S)
4,4-OXYDIANALINE				
Units: mg/m3		0.1	0.3	
PYROMELLITIC ACID DIANHYDRIDE				
Units: mg/m3			0.1	

NOTES ON EXPOSURE LIMITS:
PELs - OSHA Permissible Exposure Limits - 29 CFR 1910.1000, ubpart Z, or specific substance standards;
TLVs - ACGIH Threshold Limit Values - published by American Conference of Governmental Industrial Hygienists, 6500 Glenway Avenue, Cincinnati, OH 45211;
WEELs- AIHA Workplace Environmental Exposure Limits - published by the American Industrial Hygiene Association, 2700 Prosperity Avenue, Suite 250, Fairfax, VA 22031;
AELs - Dupont Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits are lower than AEL in effect, government limits shall take precedence;
(C) = "ceiling", limit not to be exceeded for any time period;
(S) = "skin" , skin absorption may contribute significantly to the ingredient's internal toxicity.

***** FIRST AID INSTRUCTIONS *****

Skin Contact: For skin contact, immediately wash skin with soap and water. Wash contaminated clothing before reuse.
Eye Contact: For eye contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.
Inhalation: If inhaled, remove to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion: If swallowed, do not induce vomiting. Immediately give two glasses of water. Never give anything by mouth to an unconscious person. Call a physician.

***** PROTECTION INFORMATION *****

Adequate local ventilation should be used to keep exposures below applicable limits; Other engineering controls such as totally enclosed handling systems are also preferred; Respiratory protection will be needed if exposures can not be kept below applicable limits by other means.

Respiratory Protection:
If respirators are needed to meet applicable limits, a respiratory protection program up to the level of OSHA Standard 29 CFR 1910.134 is mandatory. This includes air monitoring, selection, medical approval, training, fit testing, inspection, maintenance, cleaning, storage, etc.. Selection of a suitable respirator will depend on the properties of the contaminant(s) and their actual or expected air concentration(s) versus applicable limits. Consult ANSI Standard Z88.2 for decision logic to select appropriate NIOSH/MESA approved respitators;

Gloves:
Gloves should be used when the possibility of skin contact exists; The suitability of a particular glove and glove material should be determined as part of an overall glove program. Considerations may include chemical breakthrough time; permeation rate; abrasion, cut and puncture resistance; flexibility; duration of contact; etc.

Other Protection Practices:
Appropriate eye protection such as chemical splash goggles should be used if the possibility of eye contact exists; Protective outer clothing should be used

where the possibility of body contact exists. Contaminated work clothing should not be allowed out of the workplace; Do not smoke, consume or store food or drinks in areas where the product is handled or stored. After handling the product, wash hands thoroughly before leaving the work area; Additional engineering controls, work practices and training may be required depending on exposure levels. These are discussed in the OSHA Respiratory Protection Standard (29 CFR 1910.134) and OSHA Hazard Commmunication Standard (29 CFR 1910.1200); Do not breath dust. Avoid contact with eyes, skin, or clothing. Wash thoroughly after handling.

***** DISPOSAL INFORMATION *****

Spill, Leak or Release:

FOR SMALL SPILLS, absorb on rags, sand or other absorbant material;
FOR LARGE SPILLS, get workers out of affected area. If flammable liquids or vapors may be present, turn off electrical devices or other sources of sparks or flames. WEAR PROTECTIVE EQUIPMENT. Use supplied-air respiratory protection if vapor concentrations are not known;
Contain spill at source by diking or absorbing with sand. Do not allow spill to spread to or intentionally flush to sewer or ground. Wash area thoroughly. Adequately ventilate area;
Spill residue, cleaning rags and absorbant may be considered hazardous. (See Waste Disposal Section.).

Waste Disposal:

Components of this product may be considered hazardous;
Consult applicable Federal, State, and local regulations for allowable disposal methods.

***** PRODUCT INFORMATION *****

Contaminated Items:

Empty product containers, contaminated clothing and cleaning materials, etc. should be considered hazardous until decontaminated or properly disposed of. (See Waste Disposal Section.).

***** ADDITIONAL INFORMATION *****

SPECIAL NOTES:

The following ingredients are subject to the reporting requirements of section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR part 372:

INGREDIENT(S)	Weight %
N-Methyl-2-Pyrrolidone	> 60%
4,4'-Diaminophenyl Ether, 101-80-4	5 - 10%

DENSITY = 1.028 g/L

CALIFORNIA PROPOSITION 65: WARNING: This product does not contain chemical known to the state of California to cause cancer, birth defects, or other reproductive harm.

This product is a physical mixture. The health effects information about this product is based on the individual ingredients; The data in this Material Safety Data Sheet relates only to the specific product designated herein and does not relate to its use in combination with any other material or in any process.

Date of latest MSDS revision: 04/26/02

Person Responsible for MSDS:

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