HD MicroSystems™
An Enterprise of Hitachi Chemical and DuPont Electronics

Material Safety Data Sheet

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Tradenames and Synonyms

Polyimide Coating

Company Identification

MANUFACTURER/DISTRIBUTOR
HD MicroSystems
Cheesequake Road
Parlin
New Jersey
USA
08859

PHONE NUMBERS
Product Information : (800) 441-7515 (Outside the US (302) 774-1000)
Transport Emergency : (800) 424-9300 (Outside the US (703) 527-3887)
Medical Emergency : (800) 441-7515 (Outside the US (302) 774-1000)

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
Water	7732-18-5	0.1-1
Aromatic 100 (Petroleum Distillate)	64742-95-6	10-30
*Xylene	1330-20-7	0.1-1
*Cumene	98-82-8	0.1-1
*1,2,4-Trimethylbenzene	95-63-6	5-10
*4,4'-Oxydianiline	101-80-4	5-10
*n-Methylpyrrolidone	872-50-4	>60
Pyromellitic Dianhydride	89-32-7	5-10

* Disclosure as a toxic chemical is required under Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

HAZARDS IDENTIFICATION

Potential Health Effects

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 product, 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.

Aromatic 100 (Petroleum Distillate)

Toxic effects described in animals include: BY SKIN OR EYE CONTACT: Skin photosensitization; Moderate skin irritation; Slight eye irritation; BY INHALATION: Altered respiratory rate; Tremors; Incoordination; Salivation; Hyperactivity; Nonspecific effects, e.g., weight loss and irritation. ****Human health effects of overexposure may include: BY SKIN OR EYE CONTACT: Skin irritation with discomfort or rash; Eye irritation with discomfort, tearing, or blurring of vision; BY INHALATION: Irritation of the upper respiratory passages with coughing and discomfort; BY INGESTION: Temporary nervous system depression with anaesthetic effects, e.g., dizziness, headache, confusion, incoordination, and loss of consciousness; Nonspecific discomfort, e.g., nausea, headache or weakness. ***In addition: Skin contact may cause photosensitization in susceptible individuals.

Xylene

Toxic effects of repeated or prolonged animal exposures include: Impaired sense of hearing; changes to the tissues of the liver, kidneys, adrenals, heart, brain, spleen, lungs, and bone marrow; altered blood chemistry; decreased body weight; ****Additional animal tests have shown: Anemia; One published study reports limited data suggesting high oral doses caused an increase in malignant tumors in rats. However, other more extensive animal studies have shown no evidence of carcinogenicity. There is a report in the literature that indicates synergistic developmental effects with xylene and acetylsalicylic acid. One manufacturer reported that prolonged breathing of 500 parts per million xylene by pregnant rats caused reduced fetal body weight but did not cause birth defects. Also, high oral doses caused birth defects (cleft palate) in mice susceptible to this defect; No genetic damage in animals, bacterial or mammalian cell cultures; No reproductive toxicity. ****Human health effects of overexposure may include: BY SKIN CONTACT: Skin irritation with itching, burning, redness, swelling or rash; BY EYE CONTACT: Eye irritation with discomfort, tearing, or blurring of vision; BY INHALATION: Central nervous system depression with dizziness, confusion, incoordination, drowsiness, or unconsciousness; Nonspecific discomfort, e.g., nausea, headache or weakness; Irritation of the nose and throat; Runny nose; Sore throat; Sneezing; BY INGESTION: Central nervous system depression with dizziness, confusion, incoordination, drowsiness, or unconsciousness; Irritation of gastrointestinal tract; Heartburn; Nausea; Stomach pain; Diarrhea; Nonspecific discomfort, e.g., nausea, headache or weakness; Vomiting. ****Human effects of higher level acute, repeated or chronic overexposure may include: BY SKIN CONTACT: One or more reports in the literature indicate that repeated exposures to vapors of this substance have been associated with skin sensitization in humans; Defatting (drying) of the skin; Skin permeation may occur in amounts capable of producing the effects of systemic toxicity; BY INHALATION: Fatality can result from gross overexposure. In addition: BY INGESTION: Major ingestion hazard is aspiration which may result in "chemical pneumonia". Symptoms include coughing, gasping, choking, shortness of breath, bluish discoloration of the skin, rapid breathing and heart rate, and fever. Pulmonary edema or bleeding, drowsiness, confusion, coma and seizures may occur in more serious cases. Symptoms may be delayed for up to 24 hours.

Cumene
Toxic effects described in animals include: BY INHALATION: Pathological changes in liver; Pathological changes in kidneys; Pathological changes in spleen; BY INGESTION: Weight loss. Toxic effects of repeated or prolonged animal exposures include: BY INHALATION: Decreased blood pressure; BY INGESTION: Increased kidney weight; Additional animal tests have shown: No genetic damage in animals; No animal test reports are available to define carcinogenic, developmental, or reproductive hazards; No genetic damage in bacterial cell cultures. Human health effects of overexposure may include: BY SKIN CONTACT: Skin permeation can occur in amounts capable of producing effects of systemic toxicity; Skin irritation with discomfort or rash; There are no reports of human sensitization; BY EYE CONTACT: Eye irritation with discomfort, tearing, or blurring of vision; BY INHALATION: Temporary nervous system depression with anaesthetic effects, e.g., dizziness, headache, confusion, incoordination, and loss of consciousness; Nonspecific discomfort, e.g., nausea, headache or weakness; BY INGESTION: Gastrointestinal irritation. 1,2,4-Trimethyl Benzene Human health effects of overexposure may include: BY SKIN CONTACT: Skin irritation with discomfort or rash; BY EYE CONTACT: Eye irritation with discomfort, tearing, or blurring of vision; BY INHALATION: Temporary nervous system depression with anaesthetic effects, e.g., dizziness, headache, confusion, incoordination, and loss of consciousness; Temporary lung irritation effects with cough, discomfort, difficulty breathing or shortness of breath; Asthma-like reactions with shortness of breath, wheezing, or cough, and possibly occurring on subsequent re-exposure to concentrations below established exposure limits. In addition: BY SKIN CONTACT: There are no reports on human sensitization.

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 ORINGESTION: 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, has categorized ODA as a probable human carcinogen. ODA is not likely to be a human reproductive toxin. 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; Central nervous system; Cardiovascular system; Bone marrow; Lungs; Liver; Thyroid; Kidneys.

Carcinogenicity Information

The following components are listed by IARC, NTP, OSHA or ACGIH as carcinogens.

Material	IARC	NTP	OSHA	ACGIH
4,4'-Oxydianiline	2B		X	

FIRST AID MEASURES

First Aid

INHALATION

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash contaminated clothing before reuse.

EYE CONTACT

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION

If swallowed, do not induce vomiting. Immediately give 2 glasses of water. Never give anything by mouth to an unconscious person. Call a physician.

Notes to Physicians

Activated charcoal mixture may be beneficial. Suspend 50 g activated charcoal in 400 mL water and mix well. Administer 5 mL/kg, or 350 mL for an average adult.

FIRE FIGHTING MEASURES

Flammable Properties

Flash Point : 108 F (42 C) Calculated

KEEP AWAY FROM SPARKS AND OPEN FLAMES. Do not smoke in area with open product; If the product may be heated above its flashpoint during processing, remove sources of ignition such as open sparks, flames or static discharge to prevent vapor ignition.

Extinguishing Media

Sand, Dry Chemical, Carbon Dioxide.

Fire Fighting Instructions

Wear full protective equipment. Wear self-contained breathing apparatus. Thoroughly decontaminate all equipment used in firefighting efforts before returning to service.

Toxic decomposition products may form under fire conditions. (See Decomposition Section.) Dispose of residues per federal, state, and local regulation. (See Waste Disposal Section.).

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Evacuate personnel, thoroughly ventilate area, use self-contained breathing apparatus.

Initial Containment

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.)

HANDLING AND STORAGE

Handling (Personnel)

Avoid contact with eyes, skin or clothing. Wash thoroughly after handling. Wash clothing after use. Do not store or consume food, drink or tobacco in areas where they may become contaminated with this material.

Handling (Physical Aspects)
Avoid dust generation.

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls
Use only with adequate ventilation.

Personal Protective Equipment
EYE/FACE PROTECTION: Wear safety glasses or coverall chemical splash goggles.

RESPIRATORS: Where there is potential for airborne exposures in excess of applicable limits, wear NIOSH approved respiratory protection.

PROTECTIVE CLOTHING: Where there is potential for skin contact have available and wear as appropriate impervious gloves, apron, pants, and jacket.

Exposure Guidelines

Applicable Exposure Limits

Aromatic 100 (Petroleum Distillate)

PEL	(OSHA)	: None Established
TLV	(ACGIH)	: None Established
AEL *	()	: 50 ppm, 8 Hr. TWA

Xylene

PEL	(OSHA)	: 100 ppm, 435 mg/m3, 8 Hr. TWA
TLV	(ACGIH)	: 100 ppm, 8 Hr. TWA, A4 STEL 150 ppm, A4
AEL *	()	: 100 ppm, 8 & 12 Hr. TWA 150 ppm, 15 minute TWA

Cumene

PEL	(OSHA)	: 50 ppm, 245 mg/m3, 8 Hr. TWA, Skin
TLV	(ACGIH)	: 50 ppm, 8 Hr. TWA
AEL *	()	: None Established

1,2,4-Trimethylbenzene

PEL	(OSHA)	: 25 ppm, 125 mg/m3, 8 Hr. TWA
TLV	(ACGIH)	: 25 ppm, 123 mg/m3, 8 Hr. TWA
AEL *	()	: None Established

4,4'-Oxydianiline

PEL	(OSHA)	: None Established
TLV	(ACGIH)	: None Established
AEL *	()	: 0.1 mg/m3, 8 & **BAD UOM(12)**, Hr. TWA 0.3 mg/m3, 15 minute TWA

n-Methylpyrrolidone

PEL	(OSHA)	: None Established
TLV	(ACGIH)	: None Established
AEL *	()	: 5 ppm, 8 & 12 Hr. TWA, Skin
WEEL	(AIHA)	: 10 ppm, 8 Hr. TWA, Skin

Pyromellitic Dianhydride

PEL	(OSHA)	: None Established
TLV	(ACGIH)	: None Established
AEL *	()	: 0.1 mg/m3, 15 minute TWA

* AEL is 's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

PHYSICAL AND CHEMICAL PROPERTIES

Physical Data

Form	: Viscous Liquid.
Color	: Amber.
Odor	: Mild, Solvent.
Solubility in Water	: Insoluble

STABILITY AND REACTIVITY

Chemical Stability

Stable at normal conditions.

Incompatibility with Other Materials

Incompatible or can react with oxidizers, strong acids, strong oxidizers, water.

Oxidizable materials; Oxygen; Peroxides; Strong reducing agents; Strong alkalies;

Decomposition

Hazardous gases or vapors can be released, including carbon dioxide, carbon monoxide, oxides of nitrogen. Various hydrocarbons; Water

Polymerization

Polymerization will not occur.

TOXICOLOGICAL INFORMATION

Animal Data

Aromatic 100 (Petroleum Distillate)
Inhalation 6 hour LC50 [Rats]: >14.4 mg/L
Oral LD50 [Rats]: ~5,000 mg/kg.

Xylene
INHALATION 4 hr LC50 [RAT] : 6700 ppm
SKIN Absorption LD50 [RABBIT]: 4320 mg/kg
ORAL ALD [RAT] : 4500 mg/kg.

Cumene
INHALATION 7 HOUR LC50 (MICE): 2040 ppm
(Slightly toxic)
SKIN ABSORPTION LD50 (RABBIT): 12.3 mL/kg
(Very low toxicity)
ORAL LD50 (RAT): 2910 mg/kg
(Slightly toxic).

1,2,4-Trimethyl Benzene
Inhalation LC50 4 hour [Rat]: 18,000 mg/m3 (Soviet data)
Skin absorption LD50 [Rabbit]: No data found
Oral LD50 [Rat]: 5,000 mg/kg (Soviet 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.

DISPOSAL CONSIDERATIONS

Waste Disposal

Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations.

Components of this product may be considered hazardous.

Container Disposal

Contaminated/not cleaned containers should be treated/ handled like product waste.

REGULATORY INFORMATION

U.S. Federal Regulations
This product complies with TSCA inventory reporting requirements.

State Regulations (U.S.)
WARNING - SUBSTANCES KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER, BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM- N-Methyl-2-Pyrollidone.

OTHER INFORMATION

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

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End of MSDS