



MATERIAL SAFETY DATA SHEET

***** IDENTIFICATION *****

NAME: HD4000 SYNONYMS: Polyamic Ester.
CHEM. FAMILY: HDM Coating. FORMULA: Proprietary.

MANUFACTURER: INFORMATION & EMERGENCY TELEPHONE NOS:
HD MicroSystems™ INFORMATION: Product: (800) 441-7515
Cheesequake Road EMERGENCIES: Medical: (800) 441-3637
Parlin, NJ 08859 Transport (CHEMTREC): (800) 424-9300

All Ingredients in This Product are TSCA Listed/Reported.

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

FORM: Viscous Liquid. ODOR: Aromatic.
APPEARANCE: Amber. SOLUBILITY IN WATER: Slight.

***** COMPONENTS *****

Material (s):	CAS#	V. P. mm Hg @ 20C	Weight %
Methanol.	67-56-1	92.	1 - 5%
N-Methyl -2-Pyrrolidone.	872-50-4	< 1.	30 - 60%
Acrylate Ester.			5 - 10%
Photosensitive Polyimide Resin.			30 - 60%
Proprietary Ingredient(s).			1 - 5%

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

INSTABILITY:

The product is normally stable.

INCOMPATIBILITY:

Avoid contact with:

Acids; Bases; Oxidizing agents; Reducing agents; Free radical inhibitors; Chloroform in the presence of a strong base; Magnesium; Sulfuric acid; Oxygen; Bromine; Nitric acid; Free radical initiators; Alcohols; Light; Heat; Metals; Strong bases; Strong acids; Strong oxidizers; Peroxides; Strong reducing agents; Strong oxidizing agents; Perchloric acid; Strong alkalis; Inert gases; Chromic anhydride.

DECOMPOSITION:

Decomposition products:

Carbon Dioxide (CO₂); Various hydrocarbons; Carbon Monoxide (CO); Formaldehyde; Water; Nitrogen oxides; Silicon oxides.

POLYMERIZATION:

The product does not normally polymerize significantly.

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

FLASHPOINT: 200 F Seta CC

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 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 (see section titled GLOVES) and washing affected areas immediately if contact occurs. Volatile solvents will start evaporating during room temperature use of the product, such as thinning, pouring from jar to dispensing machine, and spin coating. Mist and solvent vapors will evolve if spray application is used. During wafer drying, 125 - 150 C, and final curing, 350 - 450 C, the remaining solvent(s) will evaporate. Potential overexposure to other chemicals used in the operation such as wafer etchants and cleaners should also be considered. Well designed area and personal air sampling and analysis can show if exposures are within established limits. Properly designed local ventilation and process enclosure are effective ways to limit employee exposure where needed.

In addition to meeting exposure limits, it is always prudent to use all practical means to minimize employee exposure to chemicals. A significant difference in overall exposure can be made with practical measures such as:

- * Inhalation - minimizing by keeping jars of product covered
- * Eye - avoiding contact by wearing chemical splash goggles where there is splash potential
- * Ingestion - avoiding by washing hands before eating, drinking or smoking, and restricting these activities to outside the work area.

PRINCIPAL HEALTH EFFECTS:

>>>Methanol

****Additional animal tests have shown: Has not been tested for its ability to cause permanent genetic damage in reproductive cells of mammals; Animal tests demonstrate developmental toxicity; No genetic damage in animals, bacterial or mammalian cell cultures; No animal data available to define reproductive toxicity; No animal data available to define carcinogenicity. ****Human health effects of overexposure may include: BY SKIN CONTACT: Skin permeation may occur in amounts capable of producing effects of systemic toxicity; Skin irritation with itching, burning, redness, swelling or rash; BY EYE CONTACT: Eye irritation with discomfort, tearing, or blurring of vision; BY INHALATION: Irritation of mouth causing coughing, wheezing, headaches, nausea and vomiting; Sore throat; Irritation of the nose and throat; Sneezing; Runny nose; BY INGESTION: May cause digestive tract irritation with stomach pain, heartburn, nausea, vomiting or diarrhea; BY CONTACT, INHALATION, OR

INGESTION: Central nervous system depression with dizziness, confusion, incoordination, drowsiness, or unconsciousness; Nonspecific discomfort, e.g., nausea, headache or weakness. ****Human effects of higher level acute, repeated or chronic overexposure may include: BY CONTACT, INHALATION, OR INGESTION: Kidney damage; Heartburn; Liver damage; Nerve damage with numbness, weakness or muscle rigidity; Fatality can result from gross overexposure. ***In addition: If metabolic acidosis occurs, visual disturbance, including blindness, may follow; Animal tests have shown teratogenic effects so, this substance may be a teratogen in humans. A teratogen is a substance that may cause physical defects in the developing embryo or fetus when a pregnant female is exposed to that substance. Odor threshold for this substance is 100 parts per million.

>>>N-Methyl -2-Pyrrolidone

****Toxic effects described in animals include: BY SKIN CONTACT: No skin sensitization; BY INHALATION: Respiration rate changes; 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.

>>>Acrylate Ester

****Human health effects of overexposure may include: BY SKIN CONTACT: Moderate irritation; May cause skin sensitization; Blistering; BY EYE CONTACT: Slight irritation; BY INHALATION: Coughing; Shortness of breath; Mucous production; At elevated temperatures, vapors may irritate respiratory tract; BY INGESTION: No known or anticipated toxic effects. ****Human effects of higher level acute, repeated or chronic overexposure may include: BY SKIN CONTACT: Skin permeation may occur in amounts capable of producing the effects of systemic toxicity.

>>>Photosensitive Polyimide Resin

****Human health effects of overexposure may include: BY SKIN CONTACT: May cause irritation; BY INHALATION: May cause irritation. ****Human effects of higher level acute, repeated or chronic overexposure may include: BY CONTACT, INHALATION, OR INGESTION: No acceptable information available to confidently predict the effects of excessive human exposure to this compound.

>>>Proprietary Ingredient(s)

****Additional animal tests have shown: No mutagenic toxicity in bacterial or mammalian cell cultures. ****Human health effects of overexposure may include: BY SKIN CONTACT: May cause irritation; BY EYE CONTACT: May cause irritation; BY INHALATION: Nuisance dust may cause respiratory irritation; BY INGESTION: Gastrointestinal irritation.

>>>Proprietary Ingredient(s)

****Human health effects of overexposure may include: BY SKIN OR EYE CONTACT: Allergic skin rashes; Nuisance particulate may cause eye irritation; BY INHALATION: Irritation of the upper respiratory passages; Irritation of the nose and throat; BY INGESTION: Headache; Nausea; Irritation of digestive tract; Diarrhea; Vomiting. ****Human effects of higher level acute, repeated or chronic overexposure may include: BY SKIN OR EYE CONTACT: Skin permeation may occur in amounts capable of producing the effects of systemic toxicity.

>>>Proprietary Ingredient(s)

****Toxic effects described in animals include: Skin irritation; Eye irritation. ****Human health effects of overexposure may include: BY CONTACT, INHALATION, OR INGESTION: No acceptable information to confidently predict effects of excessive human exposure.

>>>Proprietary Ingredient(s)

****Human health effects of overexposure may include: BY CONTACT, INHALATION, OR INGESTION: No known or anticipated toxic effects.

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; Central nervous system; Eyes; Cardiovascular system; Liver; Kidneys.

ANIMAL DATA:

>>>Methanol

Inhalation 1 hour LC50 [Rats]: > 145,000 ppm

Oral LD50 [Rats]: 9,100 mg/kg

Skin LD50 [Rabbits]: 15,840 mg/kg.

>>>N-Methyl -2-Pyrrolidone

Inhalation 4 hour ALC [Rats]: 1.7 mg/L

Oral LD50 [Rats]: 4,320 mg/kg

Skin absorption LD50 [Rabbits]: 8,000 mg/kg.

>>>Acrylate Ester

No information found.

>>>Photosensitive Polyimide Resin

No information found.

>>>Proprietary Ingredient(s)
 ORAL LD50 (MOUSE): 5,000 mg/kg
 SKIN LD50 (MOUSE): 5,000 mg/kg
 SKIN (RABBIT): IRRITATING
 EYE (RABBIT): IRRITATING.

>>>Proprietary Ingredient(s)
 Acute Toxicity LD50 [i vn-mouse]: 180 mg/kg.

>>>Proprietary Ingredient(s)
 No information found.

>>>Proprietary Ingredient(s)
 ORAL LD50 [mouse]: >1000 mg/kg
 DERMAL LD50 [rat]: > 500 mg/kg.

CARCINOGENICITY LISTING:

No ingredients of this product are designated by IARC, NTP, OSHA, ACGIH or Dupont as potential carcinogens.

EXPOSURE LIMITS:

Workplace exposures should be kept below the following limits:

Name/Units	AIHA		ACGIH			OSHA		
	8hr	15min	8hr	15min	(S)	8hr	15min	(S)
METHANOL								
Units: ppm			200	250	(S)	200	250	(S)
N-METHYL-2-PYRROLIDONE								
Units: ppm	10				(S)			

Also, DuPont has established and observes the following limits:

Name/Units	12 hr	8hr	15min	Ceiling
METHANOL				
Units: ppm	200	200		(S)
N-METHYL-2-PYRROLIDONE				
Units: ppm	5	5		(S)

NOTES ON EXPOSURE LIMITS:

PELs - OSHA Permissible Exposure Limits - 29 CFR 1910.1000, Subpart 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 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: For eye contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician; In case of eye contact, immediately rinse with clean water for 20-30 minutes. Retract eyelids often. Obtain emergency medical attention.
- 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 respirators;

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 Communication 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 absorbent 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 absorbent 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 *****

Contains photoreactive chemicals. Open and use under yellow light.

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:

** TSCA NOTICE: This material is subject to a Low Volume Use restriction under the Toxic Substances Control Act (TSCA). This material's use is restricted - only for non-dispersive use. Contact your Environmental Department for further guidance.

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 %
Methanol, 67-56-1	1 - 5%
N-Methyl -2-Pyrrolidone	30 - 60%

DENSITY = 1.128 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: 08/10/00

Person Responsible for MSDS:

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