



The MSDS format adheres to the standards and regulatory requirements of the United States and may not meet regulatory requirements in other countries.

DuPont
Material Safety Data Sheet

Page 1

PYRALUX(R) PC 1000 (VAPORS)
VPS00022 Revised 1-JUL-2005

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Product Use

Pyralux(R) photoimageable coverlays are "articles" as defined in 29CFR 1910.1200(c). A Material Safety Data Sheet (MSDS) is not required for articles. This MSDS provides information on vapors that may be released during heated processes involving these articles.

Tradenames and Synonyms

VAPORS FROM PYRALUX(R) PC 1000
PC-1000 (vapors)
PC1020 (vapors)
PC1025 (vapors)

Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS

Product Information : 1-800-441-7515 (outside the U.S.
302-774-1000)
Transport Emergency : CHEMTREC 1-800-424-9300(outside U.S.
703-527-3887)
Medical Emergency : 1-800-441-3637 (outside the U.S.
302-774-1000)

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
Vapors that evolve during lamination may contain:		
ETHYL ACETATE	141-78-6	30-60
1-METHOXY-2-PROPANOL ACETATE	108-65-6	30-60
N-BUTYL ACETAMIDE	1119-49-9	1-10
2-METHOXY-1-PROPANOL ACETATE	70657-70-4	1-5
METHYL ETHYL KETONE	78-93-3	1-5
*XYLENES	1330-20-7	1-5
*METHANOL	67-56-1	1-5
ETHANOL	64-17-5	1-5

Vapors that evolve during thermal cure may contain:

(COMPOSITION/INFORMATION ON INGREDIENTS - Continued)

METHYL ETHYL KETOXIME	96-29-7	30-70
BENZOPHENONE	119-61-9	10-30
*BUTANOL	71-36-3	10-20
UNIDENTIFIED HYDROCARBON COMPOUNDS		1-15
N-BUTYL ISOCYANATE	111-36-4	1-10
2,3-BUTANEDIONE	431-03-8	1-10
HYDROXYETHYL ACRYLATE	818-61-1	1-10
4-METHYL BENZENESULFONAMIDE	70-55-3	1-10
METHYL BENZENESULFONAMIDE PHTHALATES		1-10
2,6-DI-T-BUTYL-2,5-CYCLOHEXADIENE-1,4-DIONE	719-22-2	1-5
DIPHENYL ETHANEDIONE	134-81-6	1-5

During thermal curing (120C/250F or higher), the following is released, but at levels below the detectable limits of GC/MS:

*1,6-HEXAMETHYLENE DIISOCYANATE 822-06-0

* 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.

Components (Remarks)

The concentrations are based on GC/MS analyses of film vapors in thermal curing, the principal step where vapor evolution occurs. The quantity of vapors will depend on the specific curing cycle (typical is 1-5 lbs of volatiles per million square feet).

HAZARDS IDENTIFICATION

Potential Health Effects

Equipment used for curing must be adequately exhausted. Consult the DuPont publication, "Handling and Safety Considerations for the PYRALUX(R) PC Curing Process". Following curing, vapors may continue to be evolved in sufficient concentration so as to require exhausting until the surface temperature of the coated panel drops below 65C/150F.

During thermal curing, small amounts of 1,6-hexamethylene diisocyanate (HDI) and n-butyl isocyanate (BI) are liberated when the film is heated to temperatures >120C/250F. Measurements within the curing oven can show concentrations of HDI & BI occurring during heat-up and the first 45 minutes of cure. For this reason, curing ovens should not be opened during the interval from the time the oven reaches 120C/250F until the end of the cycle. It is recommended that the oven be allowed to cool down to 65C/150F after the cure cycle before removing cured samples. Workplace airborne

(HAZARDS IDENTIFICATION - Continued)

monitoring during a 4-hr period of continuous full oven load curing did not show any detectable amounts of HDI or BI. No detectable levels of HDI & BI are present in fully cured films.

HUMAN HEALTH EFFECTS OF OVEREXPOSURE:

Skin contact with the vapors or vapor condensate may result in skin irritation with discomfort or rash; or allergic skin rashes. Skin exposure may result in methemoglobinemia with symptoms of weakness, shortness of breath and bluish discoloration of the nose, earlobes, lips and skin.

Eye contact with the vapors may result in eye irritation with discomfort, tearing, or blurring of vision.

Inhalation of the vapors may cause irritation of the upper respiratory passages, with coughing and discomfort. Prolonged inhalation of the vapors may produce nonspecific discomfort, such as nausea, headache, or weakness. Overexposure may cause pulmonary edema (body fluid in the lungs) with wheezing, abnormal lung sounds, severe shortness of breath and bluish discoloration of the skin. Effects may be delayed. Repeated exposure may cause asthma-like reactions and chronic lung disorders with impairment of pulmonary function.

TOXICITY DATA FOR COMPONENTS:

ETHYL ACETATE

Inhalation 4 hour ALC: >8000 ppm in rats

Skin absorption ALD: >20 mL/kg in rabbits

This compound may cause eye irritation with discomfort, tearing, or blurring of vision; or irritation of the upper respiratory passages. Higher exposures may lead to these effects: temporary nervous system depression with anaesthetic effects such as dizziness, headache, confusion, incoordination, and loss of consciousness. Significant skin permeation after contact appears unlikely. There are no reports of human sensitization.

1-METHOXY-2-PROPANOL ACETATE & 2-METHOXY-1-PROPANOL ACETATE

Skin absorption LD50: >5000 mg/kg in rabbits

Eye contact may cause slight eye irritation and slight corneal injury. This material is essentially non irritating to the skin. Prolonged skin contact with very large amounts of PGMEA may cause drowsiness. Amounts ingested incidental to industrial handling are not likely to cause injury. However, ingestion of larger amounts may cause injury. Single exposure to vapors is not likely to be hazardous. Repeated excessive exposures may cause irritation to the upper respiratory tract and liver or kidney effects. Exposures having no adverse effects on the mother should have no effect on the fetus (based on the tests of the non-acetate.) Results of in vitro mutagenicity tests have

(HAZARDS IDENTIFICATION - Continued)

been negative.

N-BUTYLACETAMIDE

No information is available for this compound.

METHYL ETHYL KETONE

Dermal LD50, rabbit: 10,200 mg/kg

Inhalation 4 hour, ALC, rat: 2,000 ppm

Skin contact with liquid Methyl Ethyl Ketone may cause dermatitis with itching or rash. Repeated and/or prolonged exposure may cause defatting of the skin with itching, redness or rash. are inconclusive or unverified reports of human sensitization Eye contact with liquid Methyl Ethyl Ketone may cause eye irritation with tearing, pain or blurred vision. Contact with vapor or aerosol may cause eye irritation with tearing, pain blurred vision.

Short term inhalation exposure to Methyl Ethyl Ketone may cause irritation of the nose and throat with sneezing, sore throat runny nose.

Short term exposure by ingestion or inhalation to Methyl Ethyl Ketone may cause non-specific effects such as headache, nausea weakness. Gross overexposure may cause central nervous system depression with dizziness, confusion, incoordination, drowsiness or unconsciousness.

Simultaneous exposure to Methyl Ethyl Ketone and chemicals known to produce neuropathy may enhance the neuropathic effect of these chemicals.

Increased susceptibility to the effects of Methyl Ethyl Ketone may be observed in persons with pre-existing disease of the central nervous system.

XYLENES

Inhalation 6 hour LC50: 5984 ppm in rats

Skin absorption LD50: 12,182 mg/kg in rabbits

This compound is a skin, eye, nose and throat irritant. Prolonged skin contact can cause defatting, redness, blisters and dehydration of the skin. Skin permeation can occur in toxic amounts. Inhalation can cause nausea, headache, weakness, dizziness, confusion, incoordination and loss of consciousness.

METHANOL

Skin absorption LD50: 15,840 mg/kg in rabbits

Inhalation 1-hr, LC50: > 145,000 ppm in rats

The fatal dose of methanol by ingestion is from 60 to 250 mL. Lower doses by ingestion, inhalation or skin contact can

(HAZARDS IDENTIFICATION - Continued)

cause metabolic acidosis and optic neuropathy and blindness. Serious intoxication may occur after an asymptomatic period of 18 hours or more after ingestion. Sublethal doses may cause central nervous system depression with dizziness, headache, incoordination, confusion and coma, as well as liver, kidney, and eye effects. Methanol is a skin, eye, and upper respiratory tract irritant. Skin permeation can occur in amounts capable of producing the effects of systemic toxicity.

ETHANOL

Skin absorption LD50: > 20 mL/kg in rabbits

Inhalation 8-hr ALC: > 16,000 ppm in rats

Ethanol is an eye, nose and throat irritant. Prolonged skin exposure may cause defatting of the skin and allergic skin rashes. Short-term inhalation overexposure may cause irritation of the nose and throat with sneezing, sore throat or runny nose. Repeated or excessive overexposure may cause central nervous system depression with dizziness, confusion, incoordination, drowsiness or unconsciousness, or non-specific effects such as headache, nausea and weakness. High or chronic excessive exposure may cause reduced white blood cell production, reduced fertility in males and females, elevation of blood pressure, degeneration of heart muscles, and abnormal liver function.

METHYL ETHYL KETOXIME

Inhalation 4 hour ALC: > 4.8 mg/L in rats

Skin absorption LD50: < 1850 mg/kg in rabbits

The compound is a mild skin irritant, is corrosive in the eye, and is a skin sensitizer in animals. However, there are no reports of human sensitization. Skin permeation can occur in toxic amounts. Inhalation or skin exposure may result in methemoglobinemia with symptoms of weakness, shortness of breath and bluish discoloration of the nose, earlobes, lips and skin. Red blood cell destruction with anemia may occur. High overexposure may cause lung irritation with symptoms of cough, discomfort and shortness of breath. Methyl ethyl ketoxime does produce genetic damage in mammalian cell cultures but not in bacterial systems or in animals.

BENZOPHENONE

Inhalation 4 hour ALC: > 330 ppm in rats

Skin absorption LD50: 3535 mg/kg in rabbits

This compound may cause skin, eye, nose and throat irritation. Skin contact may cause a rash. Skin permeation may occur in toxic amounts.

BUTANOL

(HAZARDS IDENTIFICATION - Continued)

Inhalation 4 hour LC50: >8000 ppm in rats
Skin Absorption LD50: 3400 mg/kg in rabbits
Inhalation of Butanol may cause irritation of the nose and throat with sneezing, sore throat or runny nose. There are reports that suggest headache, hearing loss and vertigo (dizziness) in workers exposed to less than 110 ppm.

Skin contact with Butanol may cause redness of the skin and dermatitis with itching or rash. Based on animal studies, prolonged contact may cause skin permeation in amounts capable of producing the effects of systemic toxicity.

Eye contact with Butanol may cause eye irritation with tearing, pain or blurred vision. Contact with the vapor or aerosol may cause eye irritation with tearing, pain or blurred vision, and photophobia.

A major ingestion hazard of Butanol is aspiration (liquid entering the lungs during ingestion or vomiting) 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 develop immediately or as late as 24 hours after exposure, depending on how much chemical entered the lungs.

Repeated or excessive over-exposure of Butanol by inhalation or ingestion may cause central nervous depression with dizziness, confusion, incoordination, drowsiness or unconsciousness; impaired functioning of the blood-forming system with alterations in blood cell counts and/or anemia; and abnormal liver and kidney function with altered results on blood tests.

Increased susceptibility to the effects of Butanol may be observed in persons with pre-existing disease of the skin.

N-BUTYL ISOCYANATE

Inhalation 4 hour LC50: 15.6 ppm in rats
Skin absorption ALD: 700 mg/kg in rabbits
This compound is a skin, eye, nose and throat irritant. Contact with the eye can cause corrosion with corneal and conjunctival ulceration; contact with vapor may cause severe eye irritation with tearing, pain or blurred vision. Skin contact may cause corrosion with burns or ulceration. It can permeate the skin in amounts capable of producing systemic toxicity. Inhalation can lead to irritation of the upper respiratory passages, with coughing and discomfort. Gross overexposure can cause death. Increased susceptibility to the effects of this material may be observed in persons with pre-existing disease of the lungs.

(HAZARDS IDENTIFICATION - Continued)

2,3-BUTANEDIONE

Oral LD50: 1580 mg/kg in rats
The compound may cause irritation. Based on animal data, overexposure may cause nervous system effects.

HYDROXYETHYL ACRYLATE

Skin absorption LD50: 154 mg/kg in rabbits
This compound can irritate the nose and throat, especially as the vapor or mist. It is severely irritating to the skin. May cause severe irritation to the eye with corneal injury possibly causing permanent damage.

4-METHYL BENZENESULFONAMIDE

Dusts may be irritating to eyes and mucous membranes. Prolonged contact may cause skin irritation.

METHYL BENZENESULFONAMIDE PHTHALATES

No information is available for this compound.

2,6-DI-T-BUTYL-2,5-CYCLOHEXADIENE-1,4-DIONE

No information is available for this compound.

DIPHENYL ETHANEDIONE

No information is available for this compound.

1,6-HEXAMETHYLENE DIISOCYANATE

This compound may cause skin, eye, nose, throat and lung irritation and allergic skin rashes. Inhalation may cause runny nose, scratchy throat and cough. Overexposure may cause pulmonary edema (body fluid in the lungs) with wheezing, abnormal lung sounds, severe shortness of breath and bluish discoloration of the skin. Symptoms may be delayed. Repeated exposure may cause asthma-like reactions and chronic lung disorders with impairment of pulmonary function.

Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

FIRST AID MEASURES

First Aid

INHALATION:

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

SKIN CONTACT:

Flush skin with water after contact. 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:

Ingestion is not an expected route of exposure.

NOTE TO PHYSICIANS:

Absorption of this product into the body may lead to the formation of methemoglobin that, in sufficient concentration, causes cyanosis. Since reversion of methemoglobin to hemoglobin occurs spontaneously after termination of exposure, moderate degrees of cyanosis need be treated only by supportive measures such as bed rest and oxygen inhalation. Thorough cleansing of the entire contaminated area of the body, including scalp and nails, is of utmost importance. If cyanosis is severe, intravenous injection of methylene blue, one milligram per kilogram of body weight, may be of value. Cyanocobalamin (Vitamin B12), one milligram intramuscularly, may speed recovery. Intravenous fluids and blood transfusions may be indicated in very severe exposure.

FIRE FIGHTING MEASURES

Flammable Properties

Flammable limits in Air, % by Volume
LEL : not determined
UEL : not determined

(FIRE FIGHTING MEASURES - Continued)

Fire and Explosion Hazards:

Ovens used for curing should contain a fresh air purge to prevent vapors from accumulating where they might exceed the LEL. Consult the DuPont publication, "Handling and Safety Considerations for the PYRALUX(R)-PC Curing Process".

Extinguishing Media

Foam, Dry Chemical, CO2.

Fire Fighting Instructions

Wear self-contained breathing apparatus.

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.

Accidental Release Measures

For condensate, soak up with inert absorbent material and place in waste container for disposal.

HANDLING AND STORAGE

Handling (Personnel)

Avoid breathing vapors or mist. Avoid contact with eyes, skin, or clothing.

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use sufficient exhaust on curing equipment to keep exposures below recommended limits. Recommended temperatures for lamination and curing should be maintained to minimize vapor generation.

(EXPOSURE CONTROLS/PERSONAL PROTECTION - Continued)

Personal Protective Equipment

RESPIRATORY:

Self-contained breathing apparatus for fire fighting and mist or spray exposures, if necessary.

GLOVES:

Use neoprene gloves when handling laminator interior exhaust system and interior surfaces of connected duct work. Before removing gloves, decontaminate by washing with soap and water.

Exposure Guidelines

Applicable Exposure Limits

ETHYL ACETATE

PEL (OSHA) : 400 ppm, 1,400 mg/m³, 8 Hr. TWA
TLV (ACGIH) : 400 ppm, 1,440 mg/m³, 8 Hr. TWA
AEL * (DuPont) : None Established

1-METHOXY-2-PROPANOL ACETATE

PEL (OSHA) : None Established
TLV (ACGIH) : None Established
AEL * (DuPont) : 100 ppm, 15 minute TWA
WEEL (AIHA) : 100 ppm, 8 Hr. TWA

METHYL ETHYL KETONE

PEL (OSHA) : 200 ppm, 590 mg/m³, 8 Hr. TWA
TLV (ACGIH) : 200 ppm, 590 mg/m³, 8 Hr. TWA
STEL 300 ppm, 885 mg/m³
AEL * (DuPont) : 200 ppm, 8 & 12 Hr. TWA
300 ppm, 15 minute TWA

XYLENES

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

METHANOL

PEL (OSHA) : 200 ppm, 260 mg/m³, 8 Hr. TWA
TLV (ACGIH) : 200 ppm, 8 Hr. TWA, Skin
STEL 250 ppm
AEL * (DuPont) : 200 ppm, 8 & 12 Hr. TWA, Skin

ETHANOL

PEL (OSHA) : 1,000 ppm, 1,900 mg/m³, 8 Hr. TWA
TLV (ACGIH) : 1,000 ppm, 1,880 mg/m³, 8 Hr. TWA, A4
AEL * (DuPont) : 1000 ppm, 8 & 12 Hr. TWA

METHYL ETHYL KETOXIME

(Applicable Exposure Limits - Continued)

PEL (OSHA) : None Established
 TLV (ACGIH) : None Established
 AEL * (DuPont) : 0.5 ppm, 8 & 12 Hr. TWA
 WEEL (AIHA) : 10 ppm, 8 Hr. TWA, SEN

BUTANOL

PEL (OSHA) : 100 ppm, 300 mg/m3
 TLV (ACGIH) : 20 ppm, 8 Hr. TWA
 AEL * (DuPont) : 25 ppm, 8 Hr. TWA
 50 ppm, 15 minute TWA

N-BUTYL ISOCYANATE

PEL (OSHA) : None Established
 TLV (ACGIH) : None Established
 AEL * (DuPont) : 40 ppb, 8 & 12 Hr. TWA

HYDROXYETHYL ACRYLATE

PEL (OSHA) : None Established
 TLV (ACGIH) : None Established
 AEL * (DuPont) : 1 ppm, 8 & 12 Hr. TWA, Skin
 3 ppm, 15 minute TWA, Skin

1,6-HEXAMETHYLENE DIISOCYANATE

PEL (OSHA) : None Established
 TLV (ACGIH) : 0.005 ppm, 0.034 mg/m3, 8 Hr. TWA
 AEL * (DuPont) : None Established

* AEL is DuPont'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

Evaporation Rate : <1 (butyl acetate = 1)
 Solubility in Water : insoluble
 Odor : mild acrylate odor

Appearance : Vapors are normally colorless, but may appear as white smoke in the absence of exhaust ventilation. Vapors may condense as clear yellow liquid or a white crystalline solid.

STABILITY AND REACTIVITY

Incompatibility with Other Materials

None reasonably foreseeable.

DISPOSAL CONSIDERATIONS

Waste Disposal

When required, vapor discharges to atmosphere should be properly permitted.

REGULATORY INFORMATION

U.S. Federal Regulations

This product complies with TSCA inventory reporting requirements.

INFORMATION ON THE CLEAN AIR ACT OF 1990 TITLE VI, SECTION 611

CONCERNING OZONE DEPLETING SUBSTANCES -

DuPont Riston(R), Vacrel(R), and VALU(tm) photopolymer resists and solder masks do NOT contain and are NOT manufactured with either Class I or Class II Ozone Depleting Substances.

OTHER INFORMATION

Additional Information

PRECAUTIONARY STATEMENTS FOR VAPOR CONDENSATE AND VACUUM PUMP OIL

WARNING! CAUSES EYE, SKIN AND RESPIRATORY IRRITATION.

Oil in vacuum pump will collect and concentrate less volatile components. Condensate will contain higher percentages of less volatile components. The less volatile components include acrylate monomers which may cause delayed skin burns and may cause skin sensitization. Avoid contact with eyes, skin and clothing. Avoid breathing mist or vapor. Wash thoroughly with soap and water after handling. Laminators and curing equipment used to process PYRALUX(R) PC film should be designed with adequate ventilation to exhaust these vapors from the workplace. Vapors may condense on cold surfaces in exhaust ducts. Check these surfaces for condensate build-up before handling.

For further information regarding the safe use of this material, please refer to DuPont technical bulletin, "Handling and Safety Considerations for the PYRALUX(R) PC Curing Process".

(Continued)

MEDICAL USE: CAUTION: Do not use in medical applications involving permanent implantation in the human body. For other medical applications see DuPont CAUTION Bulletin No. H-50102.

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.

DUPONT iTECHNOLOGIES
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Indicates updated section.

This information is based upon technical information believed to be reliable. It is subject to revision as additional knowledge and experience is gained.

End of MSDS