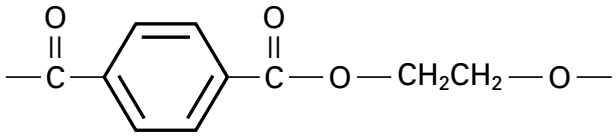
Mylar®
polyester film

Safety in Handling and Use

This booklet provides guidelines for the safe handling, processing, and disposal of Mylar® polyester film.

Mylar® is a strong, tough, clear plastic film made from polyethylene terephthalate. It has the configuration:



Its unusual balance of physical, chemical, electrical, thermal, and optical properties enable Mylar® to serve a variety of functions. It is used as an electrical barrier in capacitors and motors, as a thermal barrier in cable tapes, as a supporting carrier in magnetic tapes, and as a physical barrier in protective coatings. The optical properties, dimensional stability, and durability of Mylar® combine to make it an ideal substrate for microfilm, microfiche, engineering reproductions materials, flexible printed circuits, and diverse packaging applications.

One side vinylidene chloride copolymer barrier coated types are used as a laminating base for packaging luncheon meats, cheese, nut meats, coffee, and other oxygen-sensitive products. Two side vinylidene chloride copolymer coated types are readily heat sealable and are used for packaging tobacco products, as a general overwrap film, and for lamination to other films. In addition, other polymer-coated film types (acrylic, aluminum metallized, etc.) are available for use in reproduction substrates, flexible packaging, and other end uses.

Uncoated Film

General Properties

At ambient temperatures, Mylar® polyester film is generally inert and, in many applications, the continuous service temperature is 150°C (302°F). It is inert to most organic solvents at ambient temperatures (Ref. 1), but is hydrolyzed by strong acids and bases and, at elevated temperatures, by moisture (Ref. 2). Mylar® is not recommended for applications requiring prolonged exposure to direct sunlight due to degradation when exposed to ultraviolet rays (Ref. 3).

Toxicity

Polyethylene terephthalate (PET), in film or fiber form, has been used for more than 30 years in fabrics, industrial applications, and food packaging. It has been fed to male and female rats and dogs for three months at a dietary level of 10% with no evidence of toxicity (Ref. 4). Based on this, and other data, the Food and Drug Administration has cleared polyethylene terephthalate for use in packaging all types of food. (Refer to the “FDA Status” section.) Other toxicological investigations, including human skin patch testing, have shown Mylar® is not a primary skin irritant or sensitizer.

Combustion and Pyrolysis

Complete combustion of uncoated Mylar® yields only carbon dioxide and water (Ref. 5). However, in most instances, combustion is rarely complete for most materials. Incomplete combustion, as in an oxygen-deficient atmosphere, may give rise to carbon monoxide, acetaldehyde, methane, ethanol, dioxolane, and other products, depending on the conditions (Refs. 6–9).

Pyrolysis of PET in a vapor-phase, flow-reaction vessel at 400–500°C (752–1,022°F) produced the following identified compounds in the gases formed: benzoic acid, terephthalic acid, acetophenone, acid anhydrides, carbon monoxide, carbon dioxide, methane, ethylene, and acetylene (Ref. 10). Additional studies (Ref. 11) have identified some 30 minor (total is <0.1% by weight) pyrolysis products.

Toxicity studies, using laboratory animals, demonstrate that decomposition products formed from

Mylar® at temperatures above and below its autoignition temperature (497°C [927°F]) are no more toxic than those from douglas fir or from most other plastic materials.

Flammability

During normal processing, storage, and use, Mylar® does not present a significant flammability hazard; but like all organic materials, it will burn under suitable conditions, reaching surface temperatures of 300–600°C (575–1,110°F) and flame temperatures of 500–1,000°C (930–1,830°F) (Ref. 12). The ignition temperature in air varies from 425–500°C (795–930°F) depending inversely on the rate of heating (Ref. 13).

A limiting oxygen index of 21.1% was found for 5-mil Mylar® when tested in accordance with a modification of ASTM D2863-74. This result was obtained under controlled laboratory conditions and may not predict performance during real fire situations. The smoke generated during burning, when measured in an NBS chamber, gave a specific optical density maximum of 74 (Ref. 14).

Biological Applications

While PET is a material that is generally recognized as safe, it is not intended for uses wherein it may be implanted within the body or kept in contact with the skin for extended periods of time. The effects of long-term exposures of this type, even with intrinsically safe materials, cannot be predicted without extended studies for the proposed application. For this reason, DuPont Teijin Films prohibits the use of Mylar® polyester film in any such applications without explicit notification of the approval of such use prior to the introduction of Mylar® film in devices or products so used. Failure to comply with this prohibition may result in the termination of any and all sales contracts and commitments to companies and individuals who violate this prohibition.

Soil Burial

Mylar® is highly resistant to attack by fungi and bacteria. Samples buried in bacteria-infested soil were essentially unchanged after 36 months (Refs. 7 and 15).

Handling Practices

Ventilation should be provided for safe handling of Mylar® polyester films at temperatures above 235°C (455°F). The amount of local exhaust necessary for processing Mylar® at elevated temperatures will depend on the combined factors of film quantity, temperature, and exposure time.

Soldering and Hot Wire Stripping

Among the large uses of Mylar® are electrical insulation for wire and cable, printed circuits, and capacitors. When these components are used in electronic equipment, soldering is a routine fabricating procedure. Also, the use of a heated element to strip the insulation from wire and cable has become a routine operation.

Safe handling of Mylar® under these conditions requires the same commonsense rules applicable to any soldering job. Normal ventilation provided for worker comfort usually provides adequate safety for these operations. As an added measure during hot wire stripping, a small exhaust duct should be employed at the workbench.

Welding and Flame Cutting

Direct application of welding arcs and torches can quickly destroy Mylar® polyester film. Therefore, any film should be removed from equipment to be welded. Where removal is not possible, ventilation should be provided. Mylar® has a melt temperature of about 250°C (480°F); some in-place welding operations may be possible. Normally, the amount of film involved will be small, so ventilation requirements need not exceed those for normal welding work.

Static Discharges

Because of its good dielectric properties, a thin plastic film of Mylar® run at high speed can pick up a strong charge of static electricity. This is usually caused by rapidly separating the film from an idler roll or similar equipment. Unless this charge is dissipated as it forms, by using ionizing radiation devices or special conducting metal tinsel, it can build to thousands of volts and discharge to people or metal equipment. In dust- or solvent-laden air, a flash fire or an explosion could follow. *Extreme caution* is needed to prevent static accumulation when using flammable solvents while coating Mylar®. Solvent-coating equipment should incorporate the means for detecting and extinguishing fire.

Plastic wraps used on rolls of Mylar® may also accumulate static charges, so caution should be taken when unwrapping a roll in a dust- or solvent-laden atmosphere.

Scrap Disposal

Disposal of scrap Mylar® presents no special problems. As an inert material, it can be buried in an approved landfill. It can be burned in an incinerator with general plant refuse. The incinerator should have sufficient draft to exhaust all combustion products to the stack. Normal care should be taken to avoid breathing smoke and fumes from the fire.

Bulk quantities of Mylar® should be stored away from flammable materials.

In the event of fire, personnel entering the storage area should use a fresh air supply. All types of chemical extinguishers may be used to fight fires involving Mylar®. Water may also be used to cool and extinguish the fire.

Coated Film

General Properties

To impart heat sealability and improve barrier properties, certain types of Mylar® are coated on one or both sides with copolymers of which vinylidene chloride is the predominant monomer.

Vinylidene chloride copolymers are highly resistant to oxidation and biodegradation, which make them extremely durable under ambient conditions (Ref. 16). When heated above 120°C (248°F), the copolymers may decompose and evolve hydrogen chloride only up to 190°C (375°F) (Ref. 17). Other films are coated with acrylic copolymers or aluminum metallization (with or without vinylidine chloride copolymer overcoats).

Toxicity

Vinylidene chloride copolymers of the type used on coated Mylar® have been used as food packaging components for many years. Cellophane coated with these same copolymers has been fed to rats and dogs for two years at a dietary level of 5% without any ill effects attributable to the coating.

Thermal Stability

A volatile product of vinylidene chloride copolymer thermal degradation is hydrogen chloride (Refs. 17–19). Hydrogen chloride is an irritant for which OSHA has set a maximum permissible exposure of 5 ppm (OSHA Title 29, Code of Federal Regulations, 1910.1000).

One of the functions of the vinylidene chloride coating is as a heat sealant when the coated film is used as an overwrapping material. Overheating may lead to generation of hydrogen chloride. (Refer to the “Handling Practices” section.)

Flammability

The vinylidene chloride copolymers coatings, composed mainly of chlorine (typically two-thirds by weight), do not enhance the flammability of Mylar® and may even retard burning to some degree.

Soil Burial

Vinylidene chloride coatings are resistant to biodegradation (Refs. 16 and 20). Thus, coated films will act as inert materials upon burial.

Handling Practices

The handling recommendations for coated Mylar® polyester film are, in general, the same as for uncoated film. However, in commercial packaging operations, high temperature heat sealing bars are commonly used to seal the package. In these operations, there may be a gradual buildup of the copolymer coating or its components on the sealing bars or jaws. When this occurs, the continued exposure to heat may result in the release of fumes as the accumulated material is degraded.

To avoid this problem, the jaws should be cleaned periodically, adequate ventilation should be provided to the work area, and sealing temperatures should be controlled to avoid scorching or blistering of the coating.

When using flammable solvents, static accumulation should be avoided. (Refer to Static Discharges in the “Uncoated Film” section.) Metallized films will transfer an electrical current, so care must be exercised in their use.

Scrap disposal by burial is recommended. Scrap may be disposed of by incineration if an efficient incinerator with a good draft is used. The exhaust fumes of vinylidene chloride copolymer-coated film will contain hydrogen chloride gas and may corrode parts of the incinerator.

FDA Status

All Mylar® made and sold for food packaging complies with FDA Regulation 21CFR177.1630—*Polyethylene Phthalate Polymers*. This regulation describes polyester films that may be used safely in contact with all types of food. Polymer coated films are restricted to use below 120°C (250°F), but uncoated PET films are specifically cleared for use in oven cooking or baking at temperatures above 120°C (250°F). (DuPont recommends a maximum oven temperature of 204°C [400°F].) The US Dep't of Agriculture has accepted Mylar® for packaging meat and poultry products prepared under their inspection.

Material Safety Data Sheets

Mylar® polyester films are considered to be "articles" and are exempt from MSDS requirements per OSHA standards (29CFR1910.1200). MSDS's for Mylar® polyester film products are therefore provided upon request and are available over the Internet.

References

1. L. E. Amborski and D. W. Flierl, Ind. Eng. Chem., 45, 2290 (1953).
2. L. H. Buxbaum, Angew. Chem. Int. Ed. 7 (3), 192–190 (1968).
3. H. Pobiner and M. W. Jawitz, J. Appl. Poly. Sci., 9 (3), 1193–6 (1965).
4. E. I. du Pont de Nemours and Company, Haskell Laboratory Data.
5. W. K. Rudloff et al., Therm. Anal. Proc. Int. Conf., 3rd, 1971, 3, 205–18 (1972).
6. Y. Tokiwa et al., Hakko Kogaku Zasshi, 54 (8), 603–8 (1976).
7. S. K. Baneyoe, W. T. Koch, and E. A. Wielicki, Package Eng., Jan. 1974, 52–5.
8. Letter, P. J. Vanderhorst (PP&R), T. H. V. Speicher (Westinghouse Electric Corp.), April 4, 1972 (C-1705010).
9. I. Marshall and A. Todd. Trans. Faraday Soc., 49, 67–78 (1953).
10. R. J. P. Allan et al., J. Chem. Soc., 1957 2107–14 (1957).
11. M. Day, V. Parfenov, and D. M. Wiles, J. Appl. Poly. Sci., 27, 575–589 (1982).
12. M. Day and D. M. Wiles, J. Anal. and Appl. Pyrolysis, 7, 65–82 (1984).
13. J. H. Hedges, A. D. Baer, and N. W. Ryan, Proc. Int. Symp. Combustion, 17, 1173–1181 (1979).
14. E. I. du Pont de Nemours and Company, Circleville Research Laboratory Data.
15. G. Colin, J. D. Cooney, D. J. Carlsson, and D. M. Wiles, J. Appl. Poly. Sci., 26, 509–519 (1981).
16. R. A. Wessling, “Polyvinylidene Chloride,” Gordon & Breach Science Pub., 1977.
17. R. D. Bohme and R. A. Wessling, J. Appl. Poly. Sci., 14, 2357–76 (1972).
18. W. Machle, K. V. Kitzmiller, E. W. Scott, and J. F. Treon, J . Ind. Hyg. & Tox., 24, 222 (1942).
19. V. Henderson and H. W. Haggard, “Noxious Gases.” Reinhold Publishing Corp., New York, p. 126 (1943).
20. G. Oster, G. K. Oster, and M. Kryszewski, J. Poly. Sci., 57, 937 (1962).

DuPont Teijin Films
Barley Mill Plaza
Wilmington, DE 19880-0027
Product Information: (800) 635-4639
Fax: (302) 992-5453

Mylar®
Only by DuPont Teijin Films

(1/96) 225603B Printed in U.S.A.
[Replaces: H-05324]
Reorder No.: H-05324-1