CHEMICAL RESISTANCE OF POLYETHYLENE

Polyethylene has been the natural choice of manufacturers due to its very high resistance to a wide spectrum of reactive chemicals.

The following is technical data provided by USI Chemicals, Div. of National Distillers and Chemical Corp. They have done extensive testing and have published this information in their processing guide for polyethylene.

CHEMICAL RESISTANCE

Unstressed polyethylene at room and normal service temperatures up to 140 degrees F is highly resistant to a wide variety of rather reactive chemicals such as organic acids, alcohols, fatty oils, food chemicals and detergents used in households and industrial environments. Such corrosive liquids as concentrated sulfuric and hydrofluoric acids can be packaged in polyethylene bottles. At higher temperatures, polyethylene in the higher density ranges can dissolve in a number of common solvents. The lower the melt index within this range, the better the resistance to chemicals and solvents.

The attached table shows the degree of chemical resistance of polyethylene to various reagents. The values are obtained from tests made under static conditions using non-stressed specimens. Reagents marked with an asterisk may, under certain conditions, cause environmental stress cracking if the polyethylene products are improperly designed or not made of the best resins.

RESISTANCE TO ENVIRONMENTAL STRESS CRACKING

As emphasized in the preceding section, polyethylene resins are highly resistant to most chemical and solvents in the absence of stresses. However, many polyethylenes may crack when exposed to the same chemical "environment" under polyaxial stress, that is, while being stretched or bent in several directions at once.

NOTE: The LADTECH adjustment ring is never exposed to polyaxial stress (bent or stretched) in application. Only static and impacting compressive loads are transferred to the adjustment ring, and this is when the rings are in a contained configuration.

Thus, under unfavorable conditions, various oils or even common household cleaning agents may cause a polyethylene bag, pipe, or bowl to split after a short period of time. Bottles or bags designed to contain detergents, solvents or acids must therefor have a high resistance to "environmental stress cracking."

Failure caused by environmental stress cracking may be attributed to "stored" stresses acquired in the molding or extruding operation. These dormant stresses may release themselves by cracking under the combined influences of both the adverse environment and polyaxial stretching which may occur in use.

Polyethylene of narrow molecular weight distribution, characteristic of certain types, have slightly less tendency to crack under environmental stress. Polyethylene of melt indexes lower than 1.5 g/10 min. have a high resistance to environmental stress cracking and polyethylene types of melt index less than 1.0 g/10 min. show excellent stress crack resistance.

NOTE: Remember that the LADTECH adjustment rings are manufactured from discarded food, detergent and chemical bottles. This material typically has a melt index of less than 1.0 g/10 min. and was initially chosen because of its1 high resistance to chemicals and stress cracking.

Such resins are particularly suitable for electrical applications such as cable coating and for packaging applications – bottles and films – where contact under stress with potentially aggressive chemical may occur.

IMPERMEABILITY TO LIQUIDS AND GASES, GREASES AND OILS

Polyethylene is highly resistant to penetration by most substances, whether liquid or gaseous, chemically neutral or reactive. This is a property of prime importance for all kinds of packaging. Because of such a high degree of impermeability, many chemicals can be stored and shipped in polyethylene containers without leak hazards. Easily spoiling foods such as vegetables or meats can be shelved and sold in polyethylene bags without danger of water from the outside getting inside the bags or irreplaceable moisture being lost to the atmosphere. Exchange of gases through the film can also be kept to a minimum. Polyethylene is an ideal material for making pipe to conduct potable water. Polyethylene is also and ideal insulator for submarine cable.

For reasons explained earlier, the more crystalline the polyethylene, the less it is permeable to liquids and gases. Thus, a resin of higher density, and to a much lesser degree, of lower melt index, is more impervious to liquids and gases. Resistance to grease and oil absorption, quite important in many end products, is effectively the same property as impermeability to liquids.

In summery:

The LADTECH adjustment rings are injection molded from high-density polyethylene plastic. This material is referred to as "fractional melt" having a melt index lower than 1.0 g/10 min. This material is predominately reclaimed plastic from bottles initially used to store and transport food, household cleaners, industrial solvents and harsh chemicals. The rings, in application, are not subject to polyaxial stresses.

By virtue of the inherent properties and performance of the manufacturing material, the following statements can be made. "The LADTECH adjustment ring is resistant to stress cracking from exposure to chemicals and gases, has a high

level of impermeability and is highly resistant to the absorption of grease and oil. When used in the application intended and installed per factory recommendations, the LADTECH adjustment ring will provide a long service life with no deterioration from the environment found in most infrastructures."