# Poly Processing Company
# Position Statement
# Crosslinked and Linear Polyethylene Resins

Two types of resins are commonly used in making rotomolded polyethylene parts. One resin type lends itself to being crosslinked and is used where high performance is the driving issue. The other resin type, linear, deserves appropriate consideration where initial cost is the driving issue.

For a variety of basic applications, linear resins provide suitable service. With proper attention to product design, parts made from linear resins can give excellent performance. However, linear resins may lose significant performance characteristics if "overcured" in the rotomolding process, thus suggesting that care should be given to proper processing as well. Furthermore, some applications require enhanced performance, beyond the capability of linear resins.

For high performance applications where containment, environment, and health and safety are issues, crosslinkable resins are a better choice than linear. If the consequences of a potential spill are significant, the performance margins offered by a crosslinkable resin are well worth the price difference. The Exxon-Mobil mXL resin is a crosslinkable resin based on the metallocene catalyst system which provides the superior performance expected of crosslinkable resins.

Circumstances and environments which often require a 'high performance' resin include:

- severe chemical attack
- strong oxidization
- containment of high-value materials
- environmental sensitivity
- worker safety
- possibility of impacts or damage resulting in small cuts or notches
- extended useful life

Two key advantages of cross-linked resins for these types of applications are:

- stress crack resistance
- impact toughness
- high temperature endurance

**Stress cracking resistance**

The stress crack resistance test (ASTM D-1693, bent strip) is an established method for assessing plastic failure resistance to the combined influences of stress and chemical attack as might be encountered in the circumstances requiring a high performance resin. The drum container industry specifies bent strip testing in 10% Igepal (ASTM D-1693) as reported herein. In this test metallocene cross-link resins dramatically outperform linear resins:

Crosslink: 100% success rate in >1000 hours' service
Linear: 50% failure rate in 50-200 hours' service

**Notch and impact toughness**

Linear resins fail like a zipper. Once a crack starts, the stress concentration at the endpoint of the notch tends to unravel the plastic to failure. Crosslinked resins are notch resistant. Therefore,

notches from a forklift rubbing on the tank or from an overtightened bolt will likely result in an unzipping failure in linear resins, whereas the notch will normally be terminated without failure in crosslinked resins.

Notched Izod tests analyze the impact resistance of plastic parts. Crosslinked resins typically offer three (3) to five (5) times greater impact strength than linear resins – 17 ft. lbs compared to 3-5 ft. lbs; another considerable advantage to crosslinked resins.

**Temperature endurance**

Elevated product temperatures limit the effectiveness of both linear and crosslinked resins. Part design and UV exposure also contribute to the performance properties of polyethylene under high temperatures (above 100° F). The combination of ultra-violet additive protection, coupled with a high gel of crosslinked resins, offers additional protection when using crosslink instead of linear resin.

**Summary**

Linear resins have their place in certain basic, non-critical applications. Under high performance circumstances, crosslinked metallocene resins are the superior resin of choice.