



Cycletime Tips - General

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It is important when molding Cross-Linkable Polyethylene (XLPE) that there is a basic understanding of what actually happens during the molding process. Cross-linking materials contain additives that, when activated, instantly create links between the polymer chains and produce gases as a by-product. This occurs at a higher temperature (~160 - 170°C) than the melt temperature of the polyethylene (~120 - 125°C). To properly mold a part, all of the material needs to be melted and deposited on the inner surface of the mold before it reaches the cross-link temperature. If this does not happen, only the outer layer cross-links leaving an uncured, rough inner surface. Additionally, a “sandwich” effect may be seen if the inner layer melts and cross-links later than the outer surface. It is also important to maintain the resin in a molten state long enough for any trapped air bubbles to escape prior to cross-linking as this may result in “pinholes” in the finished product. Once the material cross-links, any defect that was in the wall of the part remains in the wall of the part. Pores or pinholes in the molds, more likely in cast aluminum, can trap air that will expand during the heating cycle creating defects in the finished product. Using appropriate heating and cooling conditions and careful inspection of the finished part should reduce these problems.

A suggested starting point for oven temperature is 290°C (550°F). Cycle time will vary based on several factors including part thickness, mold construction, etc. XLPE can be expected to take approximately 20% longer than LLDPE.

The inside surface of a properly molded XLPE part is shiny. If it is dull, the part may be under-cooked. To verify the degree of cross-linking a “Gel Test” can be done. However, this is not very practical since it involves aggressive solvents and a delay sending the sample out for testing. There are a couple of physical QC type tests that can be done to insure proper cross-linking. One is a simple bending test where a strip of plastic is cut from the part, scored with a razor, and bent backwards from the scored area. Inspection of the scored area should reveal tiny white ligaments across the bend. The strip is bent only once and should not snap in two. A stress-whitened bend indicates good fusion. The other test is a low temperature impact test, such as the one suggested by ARM (Association of Rotational Molders). Most molders simply cut a plaque from the part, place it in a freezer at -40°F for few hours, and then perform the drop impact test comparing the results with the approximate value on the material data sheet and their own experiences. Additives, such as colorants (type, addition quantities and methods), may have a profound affect on impact properties.

The parting areas of a mold can be another source of problems when molding XLPE. With the higher amount of out-gassing, “blow outs” may occur if the mold segments are

not properly aligned, kept clean, and damage free. Finished parts with pinholes along the parting line are an indication that the molds are not sealing properly. Make sure the mold segments are properly aligned and that guide pins are used and maintained. To clean the parting line some molders use wire brushes, however this may create small scratches leading to an inadequate seal. A better option would be to use copper gauze. Other molders burn off residue on the sealing surfaces by using a torch. However, this is dangerous, messy, and can melt or deform the mold if someone leaves a torch in one area too long.

Poor mold venting can also cause pinholes at the parting line. XLPE produces greater volumes of gasses than Linear PE during the molding process, requiring significantly more venting. Vents need to be larger, and if possible, more frequent, than those required for linear PE. They should also protrude further into the mold cavity. Be careful not to pack the vent tube too tightly, and it should be routinely changed, as the out-gassing can eventually plug them. NOTE: Some molders plug the vent tubes with steel wool, which is combustible, and can pose a safety hazard. Occasionally, molders will seal the inside of the vent tube by using a piece of PE film held in place with a high temperature O-ring as a rubber band. During the molding process the PE film keeps the powder inside the mold until all the powder is melted. Later, the film softens or ruptures allowing the gasses inside the mold to escape.

Keep in mind that good machine and factory ventilation is required while processing XLPE, and that personal protection apparatus is strongly advised. Additional personal hygiene is suggested to prevent skin rashes. Wash hands, arms, and face, and launder clothing daily. For additional suggestions, please contact your GP BRE Technical Service Representative or your direct material supplier.

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