IOTEK™ IONOMERS

Iotek ionomer molding guide

General

The techniques used to melt, process and mold Iotek ionomers are very similar to those used in the molding of low density polyethylene (LDPE) and other ethylene copolymers. Standard injection molding equipment can be utilized. The few differences in processing conditions, mold/part design and resin handling between LDPE and Iotek ionomers are discussed below.

Molding equipment considerations

An ionomer will typically have a 5 - 10 °C (9 - 18 °F) lower melting point than an LDPE of the same melt index. To avoid bridging in the feed section, cooling water should be used on the feed hopper throat. Hopper drying is not advisable because it will increase the possibility of agglomeration. Since ionomers with a high moisture content can generate small amounts of acid vapor at high processing temperatures (> 250 °C, > 482 °F), the use of stainless steel or other corrosion-resistant alloys or hard chrome plating is recommended.

Material handling/drying

Ionomers are hygroscopic and will absorb sufficient moisture to cause molding problems (splay, etc.) if they are stored exposed in humid air. Only resin from sealed, undamaged containers should be used, opening only sufficient inventory for about two hours of operation. Carefully opened containers can be resealed for longer term storage. Standard polyolefin handling equipment is normally utilized. A dry nitrogen purge can be employed to prevent moisture pick-up during hopper storage.

"Wet" ionomer can be dried at < 60 °C (< 140 °F) by applying dehumidified air, dry nitrogen or under a vacuum for 8 hours. A tray oven is preferable to storage bin drying to prevent pellet agglomeration.

Start-up/shutdown

Ideally start-up is begun with a clean extruder. Alternately, start-up can be easily accomplished by transitioning from another type of polyethylene (LDPE, HDPE, EVA). The rear zone temperature should be reduced to 170 °C (338 °F) as soon as possible to prevent bridging in the feed section. To transition from other thermo-plastic resins, an immediate purge with high density polyethylene (HDPE) is recommended.

Ionomers can be best purged by use of a low melt index HDPE. Because of Iotek ionomers' excellent thermal stability, machine temperatures can be cycled to improve the purge effectiveness. Ionomers' slight affinity for metal surfaces requires that effective purging techniques be used to prevent contamination when transitioning and during shutdown.

Revised 02/06 1.2

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Processing recommendations

Ionomers exhibit a much higher viscosity/melt flow dependence on melt temperature than do LDPEs. Therefore, small temperature changes yield significantly larger changes in melt flow, orientation, frozen-in stresses, and power requirements. Melt temperatures higher than the minimum temperature needed for complete mold filling are desirable to allow for relaxation of any orientation stresses thus improving the final part properties even though these higher temperatures will yield a slightly longer cycle time. The melt temperature has an upper limit (normally 260 °C, 500 °F) above which the cooling time becomes excessive due to the relatively low melting point of ionomers. Also, too high melt temperatures can produce melt fractures, air entrainment and heat sinks.

Generally, the melt temperatures used to mold ionomers range from 220 - 260 °C (428 - 500 °F), depending on the ionomer melt index. A reasonable initial melt temperature starting point for process optimization would be 245 °C (473 °F) for the lower (< 5) MI ionomers normally used in molding applications.

To prevent feed section bridging, the rear barrel temperature should be set to 175 °C (347 °F). Normally, slow to moderate fill rates and injection pressures in the range of 69 - 82 MPa (10000 - 12000 psi) will produce acceptable parts at reasonable cycle times and provide a good basis for the optimization of gate size, injection pressure, and cycle time.

A mold temperature of about 10 °C (50 °F) should eliminate any potential for mold sticking due to the ionomers' low melting points and slight affinity to metals.

Compared to LDPE, ionomers will tend to mold with less orientation but can be overpacked producing molded-in compressive stresses. Depending on the molding conditions, parts can exhibit shrinkage or expansion both of which can result in warpage. The melt temperature and injection pressure should be balanced to minimize both shrinkage and over-packing while allowing for sufficient annealing to reduce any molded-in stresses.

Regrind

Regrind rates up to 20 % can be achieved without loss of product properties and processability providing the regrind is dry and free of contamination. Regrind should be dried if it is stored for 8 hours or more.

Mold/part design considerations

Part and mold design for ionomers is similar to that for other polyolefins. Care should be taken to minimize areas where overpacking might occur and lead to molded-in stresses. The use of stainless steel or other corrosion- resistant alloys is recommended. Attention should be paid to providing efficient mold cooling to eliminate part sticking.

Safety

The normal safety precautions used when processing other molten thermoplastics should be observed. Molten ionomers will stick to skin causing burns so protective covering should be worn. At temperatures > 250 °C (> 482 °F) small quantities of fumes may be evolved so adequate ventilation should be provided. Consult the material safety data sheets for more detailed safety and disposal information.

Revised 02/06 2.2