TPE TIPS

ISSUE 4

Processing Styrenic Block Copolymer Compounds from GLS

Styrenic block copolymer (SBC) elastomers are some of the most versatile and easily processed materials in the plastics industry. They normally do not require drying, have broad processing latitudes, and have good to excellent thermal stability. Most commercial compounds are classified as general purpose and can be processed by a variety of techniques. Additionally, there are many specialty grades formulated to fit particular processes.

There are two general primary types of styrenic block copolymer compounds in the TPE industry today:

(1) *those bas ed on Styrene-Butadiene-Styrene (SBS) or Styrene-Isoprene-Styrene (SIS) polymers, and*

(2) *those based on Styrene-Ethylene/Butylene – Styrene (SEBS) or Styrene- Ethylene/Propylene – Styrene(SEPS) polymers.*

In terms of processing, the key difference between these two types of compounds is the suggested temperature profile.

GLS markets styrenic block copolymer compounds under the trade names of KRATON® and DYNAFLEX® Compounds. For both product lines, a "D" designates a compound based on SBS or SIS, while a "G" designates a compound based on SEBS or SEPS. Some

VERSAFLEX® Alloys exhibit similar processing profiles as KRATON and DYNAFLEX Compounds. Please contact your GLS representative for more information.

We can make some general observations about the processing of these two types of compounds:

PROCESSING TEMPERATURES

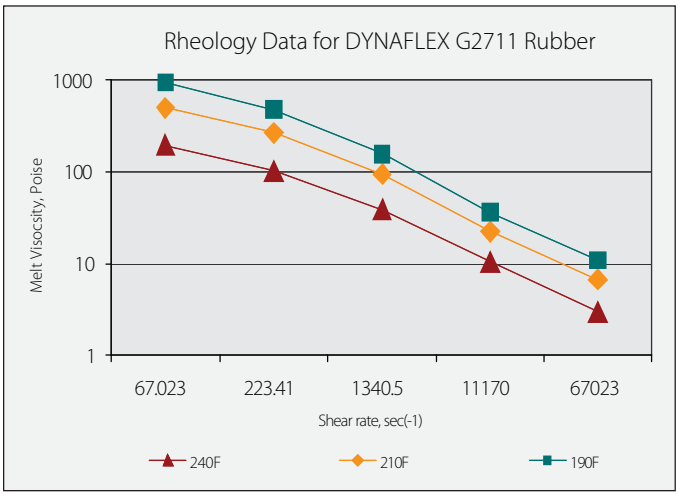
- *The SBS or SIS compounds process at temperatures similar to high impact polystyrene (HIPS) 290° to 350°F.*
- *The harder (40 Shore A and above) SEBS or SEPS compounds contain higher temperature ingredients and process at temperatures similar to polypropylene (350° to 410°F).*
- *Processing SBS or SIS compounds over 400°F may cause them to degrade, resulting in gels and discoloration. Processing most grades of SEBS or SEPS compounds over 460°F can cause them to degrade as indicated by a burnt odor. High process temperatures may also cause the oil in these compounds to volatize resulting in gas trapping.*
- *Processing at too high of a shear rate (for a given temperature) may cause the compound to separate and show splay marks around the gate. To correct this problem, raise the processing temperature and reduce the injection speed. If that fails to correct the problem, you may have to increase the gate size.*
- *A mold that is too cold, a melt that is too cold, and/or a gate that is too small lead to surface delamination (blistering) around the gate. To correct this, raise both the mold temperature and process temperatures. If that does not solve the problem, increase the gate size. Change one variable at a time.*

COOLING AND PART EJECTION

- *Soft compounds require longer cooling times to allow them to gain the full physical properties necessary to be ejected from the mold without distortion.*
- *Clear compounds have higher Coefficients of Friction (COF) and tend to be more difficult to eject from low draft cavities or cores.*

As the industry leader in soft tactile grip thermoplastic elastomers, GLS Corporation can suggest the right hardness to meet your most demanding applications.

more



SHEAR RATE DEPENDENCE

- *SEBS/SEPS and SBS/SIS compounds exhibit apparent viscosities that are affected by 'shear rate.' Most plastics exhibit this characteristic to some extent, but the effects on SEBS/SEPS and SBS/SIS compounds are more pronounced.*
- *Shear rate' is proportional to the speed or flow rate that a compound is moving against the wall of the tool. 'Apparent viscosity' is the compound's resistance to flow. A 'high flow' (low viscosity) compound gives low resistance to flow. Injection molding of thin wall parts requires a low viscosity compound.*
- *High viscosity (low flow) means resistance to flow. High viscosity is usually associated with high melt strength. Extrusion, blown film production or blow molding requires high melt strength.*
- *SEBS/SEPS and SBS/SIS compounds exhibit high melt strength and high viscosity during low shear (low flow rate) processing. They exhibit lower apparent viscosity when processed (sheared) at high rates. This property makes a single SEBS/ SEPS or SBS/SIS compound capable of being used for low shear processes extrusion) and high shear applications (thin wall injection molding).*

Your GLS sales engineer can help you determine the best choice of grades for individual applications.

MELT INDEX TESTING

Due to this unique viscosity/shear rate dependency, normal melt index testing (done at shear rates as low as 50 1/sec) will not reflect how the compound will process at higher shear rates. Shear rates during extrusion processing are usually in the hundreds of reciprocal seconds and shear rates during injection molding may go as high as 11,000 1/sec.

The graph above shows that a change in apparent viscosity may be achieved by either adjusting processing temperature or shear rate. In this example, increasing the processing speed 40% will reduce the apparent viscosity the same as increasing the process temperatures by 20°F. High shear rate viscosity testing done by GLS Corporation's Quality Control Department (using a rheometer) accurately gauges the way our compounds will perform at shear rates found during injection molding or extrusion.

Call the GLS Technical Support Team at 800-457-8777 for processing assistance or call your local GLS Sales Engineer.

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