Stabilization Technologies LLC

Denucleation of Polypropylene

Historically, the focus on both contact and see through clarity and control of recrystallization properties of polypropylene homopolymer and copolymers has been complicated by the rapid development of new polypropylene catalysts and the influences on nucleation.

The focus for many years was development of higher clarity molded polypropylene for packaging. Conventional means of modification of polypropylene was through salts of benzoic acid and other carboxylic acid derivatives followed by the introduction of sorbitol chemistries that altered both

refractive index and recrystallization of the resin but suffers from a high reactivity towards active Lewis acid species left over from high activity catalyst in many of the new catalyst systems being introduced. Therefore, the industry has gone from using 200 ppm to 1,000 ppm of conventional nucleating agents to 2500 to 5000 ppm of more expensive alternatives. These new chemistries are not much better from conventional nucleating resin systems introduced by many polymer producers. Polymer producers can achieve better refractive index and nucleation and clarity from combining additives at a significantly lower cost benefit ratio without interactions from catalyst residues.

The key here is to differentiate thermal analysis from actual contact and see-through clarity of the molded bottle. Having both contact and see-through clarity is the ultimate goal. Today this can be achieved without sorbitol chemistries and without conventional nucleating agents. Control over crystal growth and type of crystals can be controlled in both homopolymer and copolymers without additives. This control offers great opportunities to lower cost and eliminate the need for various additives in the system. Versatility of control without loss of cycle times is now possible using T-mold techniques.

Furthermore, the new factors in the global market using the latest high activity catalyst systems show a greater intrinsic self - nucleation by the polypropylene in the absence of nucleating agents.

Studies have shown this is very common in supported catalysts and those catalyst systems that leave residues behind that are either neutralized or partly neutralized on the surface but not enough to cause nucleation.

This problem is recognized by the resin producers but not a commonly known issue among those using the resin. The result has been chaos in the market place where nucleation is not warranted or needed thereby causing production problems, physical property problems and fabrication issues including warpage and shrinkage of parts.

Therefore, we have pursued the development and study of de-nucleation and means to control this problem while pursing alternative means to clarify polypropylene with expensive or conventional nucleating additives.

In the pursuit of these endeavors in 2018 we were successful in understanding the extent of the global problem and those producers and resin grades that have caused this problem. We have also found new means to control and eliminate nucleation from these resins using alternative techniques from those introduced previously with both conventional and sorbitol type chemistries.

In addition T-mold control has been optimized and conditions found to totally eliminate nucleating agents while also controlling those resins containing the best clarity using these agents. Therefore, commercial resins containing sorbitol agents with high clarity in both homo- and copolymer resins for molded containers for food contact approval fall short in both see through and contact clarity when T-molding is used. The differences are 60%

Transmission versus 95% transmission in 30 mil injection molded parts and equally better transmission in thick molding systems of 60 mils.

Bottom line regardless of the problems from resin producers to additives used to nucleate polypropylene the lack of control by the molder and chemical interactions seen from these additives in the past can now be eliminated while increasing performance and saving money.

This is just the beginning.