ACRYLIC

Impact-modified acrylics: bridging the performance gap

by John Hirsch

We are all familiar with the stalwarts of the see-through plastics market; polycarbonate, acrylic and PETG; and for the most part, we know the best applications for each thermoplastic family. We evaluate the requirements of each job, weigh the key attributes of each product, and try to select the most cost-effective solution.

And too often, the merits of extruded, impact-modified acrylics are ignored or forgotten. The last several years have seen vast strides in acrylic technology, from the basic chemistry to final fabrication. All acrylics are derived from PMMA, or polymethyl methacrylate. The most common manufacturing methods are the casting process, whether cell-or-continuously cast from monomer to finished sheet; and extrusion, from monomer to polymer (resin) to sheet. For many years, extruded plastics were considered inferior to cast products in chemical resistance, appearance and fabrication properties; but improvements in extrusion technology, and the addition of rubber modifiers, are gradually lessening the differentiators.

Nearly every major acrylic producer offers some degree of impact enhanced resin and/or sheet. Acrylate rubbers, with excellent color, toughness and weather resistance are added in some measure to the barefoot resin package. Keeping it simple, think of acrylic impact resistance on a scale of 1 to 10. General purpose acrylic sheet, with no rubber modifiers, represents the low end of the scale, and there is any number of grades available in between, depending on the needs of the target market.

Impact acrylics found an early niche in the thermoformed backlit outdoor sign face market, bridging the gap between general purpose acrylics and polycarbonate. Inherently superior in UV-resistance to polycarbonate, the addition of rubber all but eliminated the handling and shop breakage associated with traditional acrylics, and greatly improved the forming and fabrication characteristics. There were property trade-offs, of course; impact modified acrylics are less stiff and slightly "hazier" than general purpose, and cost a little more; and they are certainly not as tough as polycarbonate, but the overall cost-effectiveness solidified their position, balanced between commodity and premium performance. The chart below gives a general comparison of acrylic and polycarbonate features.

The evolution of sheet extrusion technology has advanced rapidly in the last few years, as has polymer science. Particularly in the production of optically clear products, the advent of gear-driven vs. chain-driven polishing rolls, improvements in the surface quality of the rolls themselves, cleaner material handling techniques, use of melt pumps, and configurable roll stacks have vastly improved the clarity and visual aspects of impact acrylics. Changes in the polymer chemistry have reduced edge color and haze, while adding to the toughness and surface quality characteristics. And even more recently, the molecular weight of extrudable acrylics — which dramatically affects chemical resistance, hardness and other properties — has been increased significantly, broadening the range of use even further.

This sign face was thermoformed from Tuf-Glas® CR (craze-resistant), a new high molecular weight, high impact acrylic manufactured by Spartech Plastics.

It's time to shake our old notions of impact-modified acrylics as hazy, poor surface appearance, limited choices and limited supply. Readily available in various forms from several suppliers, impact acrylics have proven effective in many new applications, including bug shields, wind screens and deflectors, utility vehicle windshields, outdoor displays, thermoformed exterior and interior parts, louvers, automotive aftermarket parts, and of course, signs.

When excellent weather resistance, formability and ease of fabrication, good toughness, clarity and scratch and chemical resistance are important, add a new/old product to your see-through selections — it could be the most cost-effective of all. ■

Acrylic and Polycarbonate Property Comparison

Performance Characteristics	General Purpose Polycarbonate	Sign Grade Polycarbonate	Extruded High-Impact Acrylic	Extruded Impact-Modified Acrylic	Extruded General Purpose Acrylic
Impact Strength	Very High	Very High	High	Average	Low
Low Temperature Impact Strength	Average	Average	Low	Low	Low
Flexural Modulus (Stiffness)	High	High	Average	High	Very High
Heat Deflection Temperature	Very High	Very High	Average	High	High
Gloss (After Forming)	Very High	Very High	Very High	Very High	Very High
Chemical Resistance	Good	Good	Very Good	Good	Good
UV Resistance	Average	High	Very High	Very High	Very High
Hardness	High	High	Average	High	Very High
Formability	Good	Good	Very Good	Very Good	Average

These typical results are based on test procedures which are believed to be reliable due to variable conditions or methods or process. No guarantees are expressed or implied including the implied warranty of merchantability and fitness for particular purposes, nor any recommendations made to infringe on patents.

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