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INSIDE

DESIGNING with Plastic

The hinged cap of the KOR ONE Hydration Vessel demonstrates plastic's ability to create integrated parts with seamless, permanent assembly. *Photo: Eastman Chemical Co.*

Through the use of plastic materials, designers are able to create innovative, intricately designed parts not possible with glass.

by fred colhoun and alan phillips

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From the early stages of product development, design engineers and manufacturers have a broad range of material specification options. While materials ranging from metal to glass to plastic strive to meet the requirements for a particular small appliance design—such as durability, design flexibility, ease of processing or coloring options—rarely does one material accomplish it all. Instead, design modifications often are made to accommodate a material's limitations.

A material that balances the positive processing and performance properties of materials common in the industry today—including glass, polycarbonate (PC) and styrene acrylonitrile (SAN)—has the potential to broaden design possibilities and differentiate products. With innovative materials such as copolyesters, designers have the opportunity to create functional and distinctive products without compromising design innovation or performance characteristics.

Differentiating with Plastic

For years, glass has served as standard material for appliance design. An attractive option for designers, glass provides a quality and eye-catching aesthetic for products throughout the home, and its clarity offers users the opportunity to view contents inside. However, in many ways, plastic resins provide increased potential compared with glass for cutting-edge design and product innovation.

Vibrant coloring. Because most colorants cannot survive the extreme temperatures required to process glass (1,400 to 1,500 deg. Celsius) using plastic materials provides designers with a wider selection of vibrant product colors. Plastics permit an increase in color options because organic colorants are less likely to degrade during material processing at much lower temperatures of 250 to 300 deg. Celsius.

In addition, the economic and processing advantages of coloring plastic resins strongly outweigh those of coloring glass. During production runs, manufacturers working with glass often experience difficulty changing or mixing colorants, limiting the variety of a product line.

Further, the lengthy changeover process required to clean glass processing equipment between production runs of different tints limits the ability to differentiate products via colors in a timely and cost-effective way. With plastic, these limitations do not exist, so designers and brand owners can distinguish products by creating the same design in a broad range of colors.

Intricate design. Through the use of

CASE STUDY: PROTOTYPING WITH PLASTIC

This blender prototype includes an aluminum base, jar and cover made of Tritan copolyester. *Photo: The Design Academy and Eastman Chemical Co.*

This juicer prototype uses circular shapes and concave profiles for its handle, carafe and cap. *Photo: The Design Academy and Eastman Chemical Co.*

Recognizing the inherent benefits of designing with plastic and eager to experiment and push its limits, The Design Academy Inc., collaborated with material supplier Eastman Chemical Company for a range of small appliance products.

Chuck Pelly, initial founder of BMW Dreamworks USA and current partner of The Design Academy Inc., began working with Eastman to test the capabilities of Eastman Tritan copolyester though conceptualizing and prototyping appliance designs. Through their work, Pelly and The Design Academy introduced several small appliance prototypes, including a blender, juicer, kettle and beater at the International Home and Housewares Show in March 2010.

Setting it apart from other thermoplastics, Tritan copolyester is manufactured without BPA, as the material's chemistry ensures the resin is free of BPA and estrogenic activity. The material also features shatter, wear and high-impact resistance, dishwasher durability and sound dampening properties.

The blender prototype designed by Pelly, including an aluminum base and a jar and cover made of Tritan copolyester, has a contemporary, futuristic appearance, which combines clarity and a metallic luster with defined, crisp edges and smooth surfaces.

Designing with plastic provided The Design Academy control of complex surfaces and textures of the blender jar and lid to create drastically different cuts ranging from gentle curves to sharp, defined corners. In designing the blender prototype, the designers sought to emulate fluidity and water, therefore requiring the flexibility to cut and shape the material in unique ways. Using plastic allowed the designers to create double radii curves, producing a wavelike blender lid and a cascading side panel.

With the freedom to manufacture parts of significant thickness using the copolyester, the designers created thick-to-thin wall transitions within the blender jar. With some materials, achieving thick sections or sharper thickness transitions can create variable residual stress in the molded part, often leading to cracking in the dishwasher. To reduce the stress that can lead to part failure, extended processing cycles, or time- and energy-intensive external annealing processes are required. However, the lower residual stress formed during the molding of Tritan helps eliminate this need for post-processing procedures. Also, despite the thickly molded plastic walls, the blender jar remains lightweight, approximately half the weight of a comparable glass jar and easily manageable, even when filled to capacity.

Experimenting with the ability to tint plastic a wide variety of colors, the blender prototype also exhibits the coloring options possible with copolyester materials. Merging color with glasslike transparency, the prototype puts function on display so users can clearly see the appliance at work.

One of the other prototypes, a juicer, was designed to combine both functional and aesthetic material qualities, and to demonstrate a successful integration of design and material selection. The manually operated juicer uses circular shapes and concave profiles for its handle, carafe and cap.

The juicer cap has four positions to allow varying levels of pulp filtration depending on filter design. Each filter level—pulp, medium, fine or no pulp—is clearly indicated on the juicer cap through embossed labels.

In addition, the juicer prototype is dishwasher durable. As an appliance product with the potential to undergo frequent high-temperature washing cycles and exposure to acidic juices, the prototype exhibits copolyester's durability against everyday household use, as well as to harsh or aggressive dishwashing chemicals. ■