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Ultrasoft TPEs march forward

Overmolding soft-touch TPEs has become a way of life for many molders, and the design community also remains committed to these materials for their ergonomic and aesthetic qualities. Recently GLS Corp., a soft-touch TPE compound supplier, introduced Versaflex CL2003, a water-clear, injection moldable, gel-like TPE with a 30 Shore 00 hardness. This material leads the way for a new TPE class, the ultrasoft grades, because the technology used to make CL2003 can also be used to create TPEs as soft as 5 Shore 00.

According to GLS, the new grade is engineered to meet the needs of applications such as gel bicycle seats, wrist pads, shoe sole inserts, furniture arm rests, and grips for personal care products.

BEST FOOT FORWARD

Pittsburgh Plastics, the official licensee of Champion Performance Insoles and owner of the Comfort Star foot care brand, is currently using Versaflex CL2003 for shoe sole inserts. The company has two divisions—a consumer products side and a custom contract manufacturing operation that supplies OEM components and subcomponents.

According to Steven Nourie, sales manager for the company's contract manufacturing division, the new material represents life imitating art. "It's like Flubber, a great Disney flick, and now we have the real thing," he says. "With it, you can jump higher and run faster. We are producing the vision of 20 years ago."

Pittsburgh's molding operations specialize in TPEs. Its six presses range from 75- to 500-ton capacity and can accommodate single- or multiple-cavity mold production. Pittsburgh also has the ability to comold to like materials or overmold to some plastics and other substrates, such as fabrics.

While it had been making encapsulated gels (gels in a bag), it's now pushing to injection mold the soft

TPE directly onto fabrics for applications like knee, ankle, and elbow braces. "Currently, we have to sew the pad in," Nourie says, "but if we mold onto the fabric, it could give similar cushioning so that TPEs could replace the gel."

At this company, injection molding is the most automated of its processes. In typical molding fashion, soft TPE material is heated to the plastic-flow phase, and then injected under pressure through sprues into the mold cavity. According to Nourie, the sprue design is critical for even, economical part formation. Molds are heated and simultaneously cooled to balance plastic flow and part solidification.

So far, Pittsburgh Plastics has manufactured more than 20 million insoles and supplied products to many of the top names in the foot-care industry. "We have driven the gel-insole category since the early '90s," says Nourie, "and currently supply foot-care components to customers in 25 countries. Along the way, we developed great relationships with companies that wanted us to make products utilizing our manufacturing capabilities on an OEM basis. Thus our second division, Custom Contract Mfg., was formed in 1997. It has grown faster than we ever expected and generates more than 50 percent of our revenue. We now make OEM components for market leaders worldwide."

Working with GLS, Pittsburgh Plastics has made sample parts even softer than CL2003. "The market we are going after is softer polymers and components, because the mechanical and processing capabilities are significantly different," he says. For example, Nourie explains that mold design, especially runners and sprues, changes with the softer TPE materials. The company has created several



Applications for GLS Corp.'s Versaflex TPE include bike seats, furniture arm rests, wrist pads, foot and personal care products, and product grips.

generations of tooling so that it can conduct experiments on how the material will flow. "There's no empirical data. It flows differently at different tempera-

tures, and different gating arrangements affect the flow significantly. Multiple cavities also change the dynamics."

Injection molding represents a good portion of the Champion line of impact products for high-level sports, where the focus is a combination of design and materials for insoles. Pittsburgh's Comfort Star line is more broad-based and includes medical toe spreaders in which TPE replaced silicone for a lower-cost alternative.

Over the past few months, Pittsburgh has overcome the hurdles of injection molding ultrasoft TPEs onto fabric, including issues such as washing, drying, and reuse. "We have samples out to athletic brace OEMs, with major players interested. There are also development contracts with medical and sports OEMs," says Nourie. It appears to be only a matter of time before this new class of Shore 00 TPE materials makes its way to market.—Michelle Maniscalco



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WHAT IS SHORE 00?

If you've never heard of the Shore 00 hardness scale, you're not alone. IMM asked GLS materials engineers to explain the relatively unfamiliar scale. Their response follows, but, in short, this scale was developed for gel-like materials, and ultrasoft TPEs fall into this category.

- All soft-touch TPE products are characterized by their hardness, defined as a material's resistance to indentation or penetration. The hardness of a material is measured by a Shore durometer. This instrument uses an indenter to penetrate the specimen—the degree of penetration determines the hardness of the material. The greater the penetration, the lower the hardness of the material.
- There are three different Shore durometers (D, A, 00) commonly used to measure the hardness of polymeric materials. The Shore D durometer is used for fairly rigid plastics, Shore A is for flexible plastics/TPEs, and the Shore 00 is for ultrasoft, gel-like materials.
- Each Shore hardness scale ranges from 0 to 100; 0 means full penetration and 100 is no penetration. Since each scale is accurate only from 20 to 90, readings outside this range should move to the next lower or higher hardness scale. As a result, the three hardness scales overlap each other slightly (see chart).
- In cases where the Shore A hardness is greater than 90, the Shore D durometer is more appropriate. For materials with a Shore A hardness less than 20, the Shore 00 durometer can be used. Materials that fall in this hardness range have gel-like characteristics, such as gummy bear candy.
- Hardness is often confused with flexural modulus or coefficient of friction (COF). The flexural modulus is a measurement of a material's resistance to bending, while COF is a measurement of the degree of resistance an object experiences as it slides across the surface of the TPE ("grippy" vs. smooth). Two TPE materials can have the same hardness, yet have two different surface feels (rubbery vs. silky smooth) or different flexural modulus values.
- Most TPEs developed in the last 10 to 15 years were constrained by hardness. Softer TPEs (less than 45 Shore A) with good performance and processing characteristics were difficult to achieve. In recent years, GLS has been able to produce soft TPEs with hardness values from 30 Shore A down to a gel-like 3 Shore A. Several of these materials are manufactured into clear, free-flowing pellets that can be processed using standard injection molding equipment.

