DSM Somos®
The Part We Play

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DSM Somos® ProtoComposites™ and Rapid Tooling

Injection Molding with Somos ProtoComposite™ SL Resins

When DSM Somos approached Paramount Industries, a full-service design house in Langhorne, PA, with a vision for using ProtoTool 20L™ to make injection molds, the irony was that Paramount's RT experience included everything *but* SL resins.

"Today, High Speed (HS) CNC machining is our rapid tooling standard," says Paramount President & CEO Jim Williams. "During the last 30 years, we've developed products using cast epoxy composites, cast aluminum, cast S7, spray-metal, cast beryllium, KelTool, SLS RapidSteel™ and machined tools.

But the thing that caught Paramount's attention was the exceptionally high heat deflection temperature of the composite ProtoTool 20L material as compared to neat SL resins. "A major reason for the previous failures of unreinforced SL resins in injection molding has been their inability to withstand elevated temperatures. ProtoTool's low pressure HDT is almost 500ºF—a temperature that exceeds the processing temperatures of many commonly molded engineering thermoplastics."

In addition to its ability to withstand high temperatures, ProtoTool's high ceramic content also offered increased hardness (providing abrasion resistance and durability during the molding process), plus very low shrinkage, moisture absorption and coefficient of thermal expansion (for high accuracy).

"What intrigued me was the promise of a new, resilient SL material, combined with the reliable machine accuracy now available with the 3D Systems Viper—two critical components missing from prior rapid tooling art," says Williams.

Paramount agreed to begin experimenting with Somos composite materials for rapid tooling applications and recently presented results of three case studies in a paper titled, "Injection Molding with Composite Stereolithography Resins." One of those case studies is presented here.

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Unlimited. DSM

Injection Molding with Somos ProtoComposite™ SL Resins

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Case Study
Paramount had been working with a product development team at a division of Ingersoll Rand (IR) for nearly a year developing a new line of high-speed, hand-held air grinders. The new product line was being engineered to transition from machined metal components to lower-cost injection molded thermoplastics. The predominant resin used was a Nylon-6, with 33% glass filler—a material typical for robust and abusive industrial environments.

When production tooling was near completion and first articles began arriving from IR's China supplier, a problem was discovered. The main body housing is cylindrical with compound surface geometry on the exterior surfaces—but the surface geometry was interpreted incorrectly based on the 3D CAD data sent to their supplier. This error translated to the inside of the body housing.

The IR engineering team considered their options. They could request the vendor to correct the body housing, but this decision would put them 4-5 weeks behind schedule. Testing the part using RP materials, or cast urethane, was not an option. Nothing but Capron would work, as motor speeds of 30,000 rpm and accelerated air velocities could create temperatures challenging for most thermoplastics.

The team discovered they might be able to modify an internal part called a "cage" to compensate for the error, but the theory needed to be tested. They needed at least two parts molded in Capron to verify their design concept. If it worked, they would have their China vendor change the Cage tool. Choosing this option would allow them to begin assembly 2-3 weeks sooner.

Somos ProtoTool 20L™ was used to create a mold designed with a tunnel gate. A machined metal insert was added to counter the abrasiveness of the glass filler, which would have quickly deteriorated the SL resin in this high pressure, high flow area.

Paramount was able to deliver the SL molded parts within two weeks from first receiving 3D data. The parts measured well within nominal manufacturing tolerance for injection molding (+/- .005 In/in) and the customer was able to use them successfully for their engineering pilot performance evaluation.

When queried about the usefulness of the parts, the customer described them as "quite functional" and relayed that they were being used in an engineering pilot build along with other production molded components.

Below: The standardized HDT test provides a comparative measure of resistance to flexural deformation under specific test conditions. Composite materials such as ProtoTool™ 20L and Nanoform™ 15120 exhibit heat deflection temperatures ranging from 100% to 500% higher than those of neat SL resins, depending on the standardized load condition—low vs high.