Optimizing Molding Processes

Injection molded silicone resins are being commercialized for optical parts in a variety of applications. These silicones are well suited to precision molding, as micrometer-sized features can be replicated on the lens surface for benefits in directing light output. Silicones have been fabricated using a variety of techniques, including injection molding, casting/cavity molding and others. However, the optimal molding equipment and processing conditions are very different from traditional thermoplastics or liquid silicone rubbers. In order to assist customers in evaluating these materials without the high cost of capital expenditures, Dow Corning has installed equipment to prototype and help optimize molding processes for manufacturing of silicone lenses or optical parts.

The primary equipment in Dow Corning’s Auburn facility is a Sodick Plustech 40-ton horizontal injection molding machine, which can accept molds up to 310 mm (12.2") between the tie bars for installation with a 100 mm (3.9") mounting ring. The unit is a V-style plunger design capable of metered shots up to approximately 12 grams. Larger shots can be made with modified intrusion software to partially fill the mold using the fill screw and doing final pressure and fill with the plunger. The unit has controls for two sets of heaters, maximum capacity of 2 kW for the unit. Typically ½" cartridge heaters are used, while the thermocouple for control can either be remote via bayonet mount or included in the heaters. Note that this equipment utilizes type K thermocouples.

In order to make prototyping more cost effective, we also have a Progressive Components RTI® 08/09 Rapid Tooling Insert Frame. Drawings of the U-frame are shown in sketch A below. This unit will accept 5" x 8" Solid Units (RTS-0809), 5" x 8" Laminated Units (RTL-0809) or 7.85" x 9" T-Style Units (RTT-0809). Please contact us for details prior to cutting steel on these inserts.
In general, we recommend keeping the sprue length as short as possible for both waste and removal considerations. The sprue should have a larger draft angle than that typically used for liquid silicone rubber or plastic and should be draw polished to allow for pulling of the sprue. Cavities are typically highly polished for optical parts, but the runners should also be polished to prevent the material from sticking. Ejector pins, if used, should be a tapered design with a small amount of preloading to seat them in order to prevent flash down the pin and into the movable portion of the mold. Gates are designed to prevent turbulence; impingement as in plastic molds is not recommended. Fill should be from the bottom of the cavity with venting at the top to allow bubbles to escape. The materials are very flowable at mold temperatures. Drawings of the prototyping inserts are shown in sketches B and C at right.

To further reduce prototyping costs, we also have a rapid tooling insert with pre-machined pockets for core and cavity inserts available. This is the RTI® Complete as shown in sketch D. This unit incorporates a 3” x 5” insert, which can be cut and placed into the tool. While limiting the design flexibility and size slightly, this can be an inexpensive way to obtain a small number of sample parts.

For all of these mold options, we do not have machining capability in-house, but do have access to local tool and die shops that can prepare such molds at a reasonable cost. Machining costs are typically borne by the customer.
Drawings used with the permission of Rapid Tooling, Inc. Additional input on Rapid Tooling Inserts (RTIs) from Progressive Components can be obtained at www.procomps.com, or by calling 1-800-269-6653.
If a customer would like a demonstration of molding capability or to see a material in use, we do have some standard molds that can be demonstrated or used to prepare parts. These are a standard “dog-bone” tensile bar (as shown below), a ~35mm aspherical lens and a few different sized rods. Parts from these molds are often available on a limited basis.

Please contact your local Dow Corning sales representative with questions or to schedule a visit or prototype run.

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