



Automotive Headlamp Lens Technology from Covestro

## Processing Information for Automotive Lenses

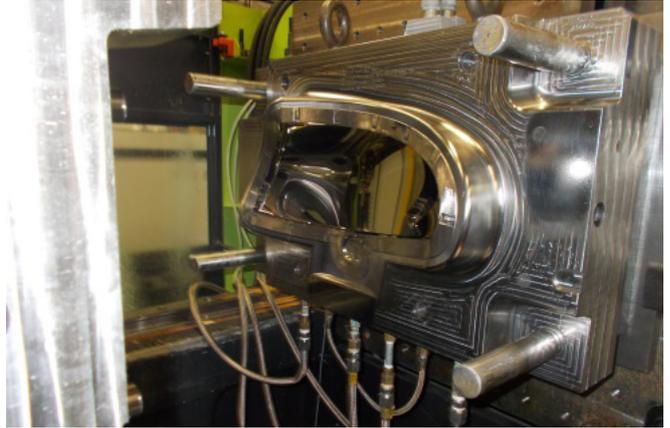
Makrolon® AL2447 and AL2647 polycarbonate are the two main products offered by Covestro for production of automotive lenses. The Makrolon® AL2647 polycarbonate grade is used in many lenses that have standard filling requirements, while the Makrolon® AL2447 polycarbonate grade offers additional flowability (i.e. lower melt viscosity) and allows molders to fill lenses with longer flow lengths and/or thinner nominal wall sections. Both material grades are supplied in pelletized form in either 750kg boxes or via bulk truck delivery to customer storage silos.

Makrolon® polycarbonate is a hygroscopic material. This means that the pellets will absorb moisture from the environment during transportation and storage. In order to produce tough, transparent, defect-free lenses, the residual moisture in the material must be removed prior to injection molding. Typically, a desiccant-type dehumidifying dryer is used to accomplish this task. In this kind of dryer, the Makrolon® polycarbonate pellets are held in a hopper, and hot dry air is circulated through them. The moisture that is removed from the pellets during this operation is captured in desiccant beds in a separate unit. The desiccant beds are regenerated (i.e. dried) on a regular schedule so that the air being passed through the pellets remains extremely dry. Standard drying conditions for Makrolon® polycarbonate are four hours at 250°F, and the dew point of the circulating air should be less than -20°F. The residual moisture content in the material prior to injection molding must be less than 0.02% in order to avoid moisture-related processing defects and material degradation.



Typical injection molding conditions used to produce automotive lenses from Makrolon® AL2447 and AL2647 polycarbonate can be found in the table below.

Recommended Processing and Drying Conditions		
Melt Temperatures	C	280 - 320
Standard Melt Temperature	C	300
Barrel Temperatures - Rear	C	250 - 270
Barrel Temperatures - Middle	C	270 - 290
Barrel Temperatures - Front	C	285 - 305
Barrel Temperatures - Nozzle	C	270 - 305
Mold Temperatures	C	70 - 110
Hold Pressure (%of injection pressure)	(%)	50 - 75
Plastic Back Pressure (specific)	bar	100 - 200
Peripheral Screw Speed	m/s	0.05 - 0.2
Shot-to-Cylinder Size	%	30 - 70
Dary Air Drying Temperature	C	120
Dry Air Drying Time	h	4
Moisture Content max. (%)	%	<=0.02
Vent Depth	mm	0.025 - 0.075



These conditions can be used as a good starting point when developing a process for a new headlamp lens mold. The parts molded at these conditions will provide feedback about further adjustments that may be necessary in order to produce good parts from any given lens mold. Lenses that have complicated geometry and/or design features such as screw bosses, ribs, locator features, molded-in lettering, etc., will likely require further refinements to the filling speed profile in order to eliminate cosmetic defects that could result from these features. Special attention also needs to be focused on minimizing molded-in stresses during the development of any lens molding process. Melt temperature, mold temperature, and packing pressure and time need to be optimized to ensure that the molded lenses can resist chemical attack from the solvents used in the hardcoat and anti-fog coatings that are applied after the lenses are molded.



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