

Automotive Headlamp Lens Technology from Covestro

Minimizing molded-in stresses in automotive lenses

Automotive headlamp outer lens covers (commonly called headlamp lenses) molded from Makrolon® polycarbonate need to withstand harsh environmental conditions and impacts from rocks and other road debris during their lifetime. They must also withstand solvents in the hardcoating and anti-fog coating products that are applied to them during the manufacturing process. To help the molded lenses survive these conditions, it is important to minimize molded-in stresses in the lenses during the injection molding process. An automotive headlamp lens that has high levels of molded-in stresses may exhibit crazing and/or cracking during the coating process. This is caused by chemical attack from the solvents used in the hardcoating and anti-fog coating products that are typically applied to the molded lenses.

An easy way of determining the amount of molded-in stresses in a clear automotive lens is to use a strain viewer (polariscope).

When an automotive lens that contains high levels of molded-in stresses is viewed in the strain viewer, it will typically exhibit a large amount of tightly spaced, bright-colored bands. This phenomenon is commonly known as birefringence. The strain viewer can be used as an optical tool to minimize the molded-in stresses in the lens. After making the appropriate adjustments to the processing conditions to minimize molded-in stresses in the lenses, the amount of tightly-spaced, bright-colored bands (fringes) should be reduced, the spacing between the remaining fringes should be greater than originally seen, and the majority of the lens area should exhibit a clear or light gray tint that is devoid of any fringes.

Certain design features, such as screw bosses, locator features, ribs, and thicker optical features, will always have some remaining fringes in and around them, but the goal is to achieve a general fringe-free area across as much of the molded lens as possible.

Some of the adjustments that can be made to injection molding conditions in order to minimize molded-in stresses in automotive lenses are as follows:

- Increase mold temperature
- Increase melt temperature
- Reduce packing pressure
- Reduce packing time
- Optimize filling speed – should not be too fast or too slow

