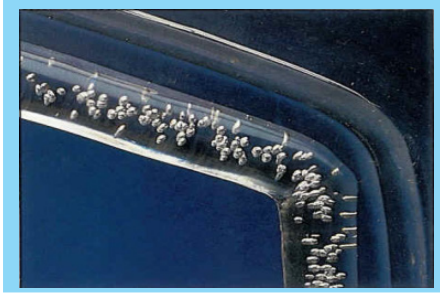
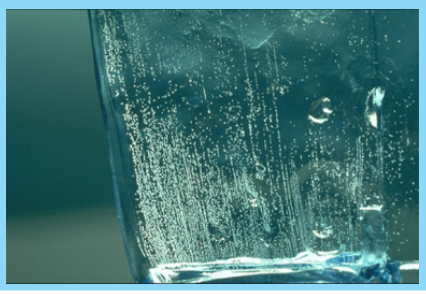
Automotive Headlamp Lens Technology from Covestro

Common defects that may occur during automotive lens molding

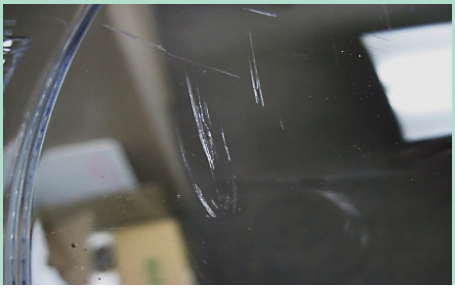
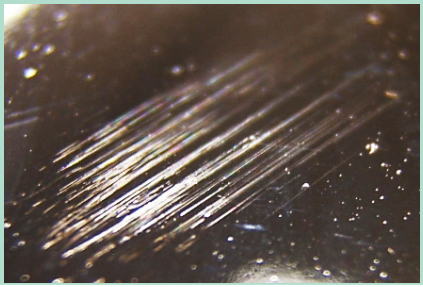
Splay

This defect can range in appearance from tiny bubbles or streaks on the lens surface, typically caused by insufficient drying, to larger individual defects, typically caused by such things as air entrapment in lens features, flow disturbances during filling, material shear heating during filling, material overheating in the molding machine barrel and/or hot manifold system, etc.

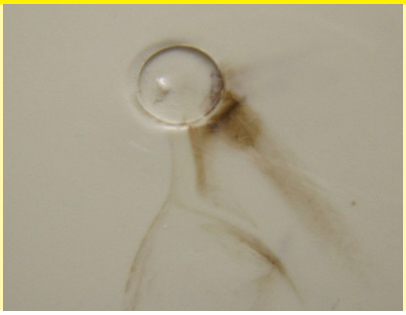

Cold Slugs

This defect is usually found near the gate where the melt enters the lens, but it can also be found further away from the gate. Cold slugs are caused when a small "slug" of cooler melt from the molding machine barrel, nozzle, or the hot manifold system, makes its way past the cold slug catch wells in the runner system and gets into the lens.

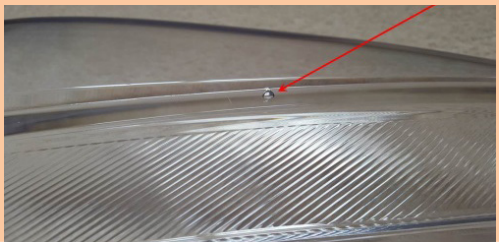
Burning

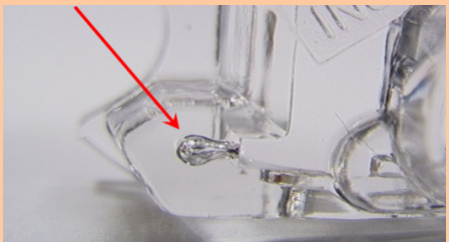
This defect can appear as brown swirls near a valve gate or hot drop location, which means there is usually material hang-up/degradation occurring near the tip of the drop. It can appear throughout the molded lens, indicating there is likely something in the barrel, nozzle, or manifold system causing material hang-up/degradation.



Bubbles in thick sections

Larger bubbles that form in thick wall sections, especially when they are far away from the gate or where the thick wall section is being filled by a thinner wall section, are shrinkage voids that form as the melt is cooling and solidifying. This is actually a part design defect. Every effort should be made to maintain a consistent wall thickness throughout the entire lens to avoid formation of these defects.





Cloudy swirls

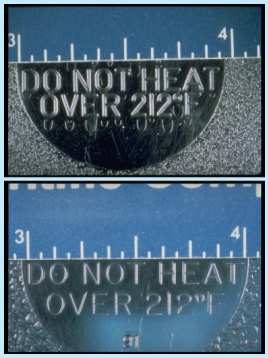
Milky-white cloudy swirls in the molded lenses are typically caused by contamination from foreign materials. This could range from pellets of a different type of material getting mixed in with the clear PC pellets to pieces of the box liner bag that get torn and mixed in with the clear PC pellets. In either case, a review of pellet handling procedures should be conducted and corrective action implemented.

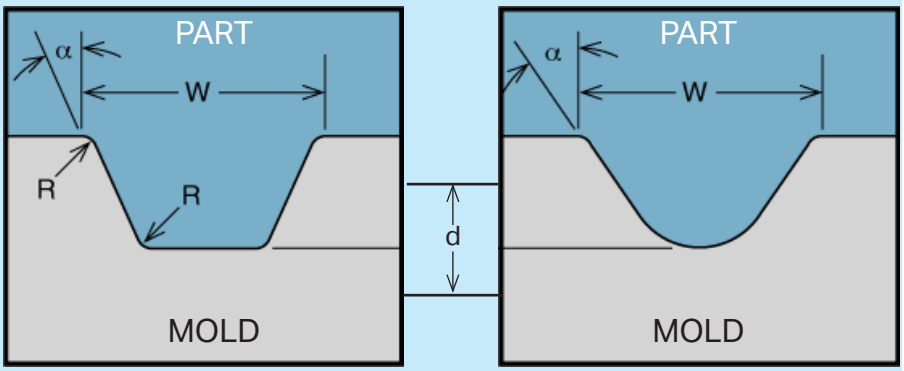
Black Specks

While molding automotive lenses using Makrolon® polycarbonate over extended periods of time, a layer of carbonized material forms inside the molding machine barrel, nozzle, and hot manifold system. If this carbonized layer gets disturbed by temporary cold shutdowns, material changes, running wet material, etc., small pieces of it can break off, creating black specks in the molded lenses. To help avoid black specks, it is imperative that the barrel heaters should never be turned off during short- or long-term shutdowns. Instead, the heaters should be "banked" at 300°F – 320°F to avoid disturbing the carbonized layer and having small pieces of it detaching from the heated metal surfaces in the melt path.

Flow marks at lettering locations

If proper design guidelines have not been followed when cutting letters and numbers into automotive lens molds, small flow mark defects can form as the melt fills the lenses and flows across these features. Refer to the guidelines below to avoid this problem.

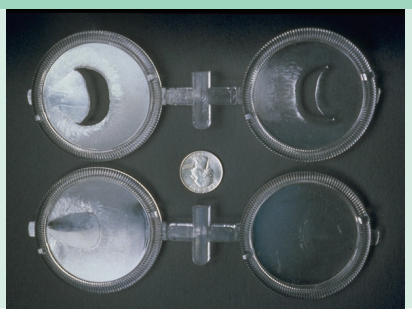




$\alpha \geq$ **30°** $\mathbf{W} \geq$ **2d** **d = 0.010in (max)**

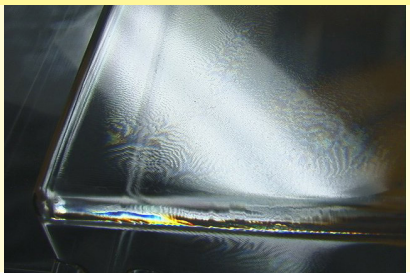
Air Entrapment

Some automotive lens designs are susceptible to air entrapment, which is caused by the melt "racetracking" around the outer perimeter of the part during filling and closing off the venting locations before all of the air has been pushed out of the part. While this problem should be discovered and corrected early on during mold filling analysis, sometimes it is not. To correct this issue, part wall thickness adjustments can usually be made, eliminating the air trapping.



Cold Flow Ripples

This defect, sometimes called "record grooves," typically occurs when the melt flow front stalls out and is unable to fully pack out the part. Main causes for this defect include the melt temperature being too cool, mold temperature being too cool, filling speed too slow, insufficient packing pressure, insufficient wall thickness, insufficient venting, and gate size too small.



Brittle Parts

This defect can be caused by a number of different factors. Main causes include insufficient material drying, using too high of a melt temperature, too much material residence time in the barrel of the molding machine (barrel capacity too large for shot size) and using regrind that has been previously degraded.

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