AGGRESSIVE STYLING FOR AUTOMOTIVE LIGHTING APPLICATIONS

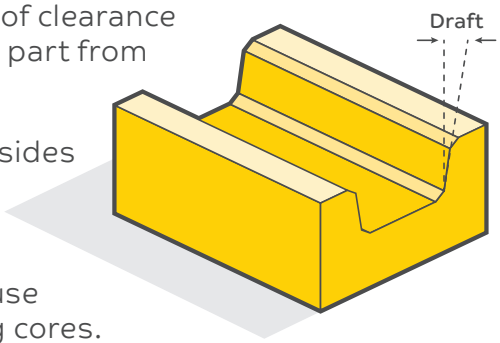
Forward and rear lights on vehicles are constantly evolving. With new technologies and styling ideas, lighting systems are becoming more complex all the time.

When it comes to styling, the imagination seems to know no limits as automakers seek to increase the appeal and distinctiveness of their vehicles, while allowing for increased functionality.

How can lighting engineers and designers bring ever-more intricate and stylish designs to the road?

IMPORTANCE OF DRAFT ANGLES

Aggressive styling requires sharper draft angles. When designing injection-molded parts, you must follow some fundamental rules. One is the requirement of a draft angle – the degree of taper of the mold's sidewall or the angle of clearance allowing for the removal of a part from a mold.



If you try to mold a box with sides that are 90 degrees to the base, you will never remove it from the tool without substantial ejector force or use of some complicated moving cores.

The draft angle improves the "moldability" of your part and reduces the chance for damage from friction during release. Among other benefits, draft angle helps ensure an aesthetically pleasing, uniform and unscratched surface finish. Draft angle also can reduce the potential for damage to the mold itself.

The degree of the draft angle depends on the molding material. For polycarbonate (PC), the minimum draft angle is between three to five degrees. Polybutylene terephthalate (PBT), by contrast, has a minimum draft angle of five to seven degrees.

A low draft angle is critical for enabling greater styling freedom and can help reduce packaging space as it enables the smaller optical surfaces, which are typical for LED-based headlamp designs. In addition, it can allow for deeper light units, while maintaining minimal frontal surface.

AUTOMOTIVE EXPERT SERIES

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AUTO-AL-HF-001-EN-070319

However, the lower the draft angle, the more problems that can arise, like scuff marks and higher scrap rates.

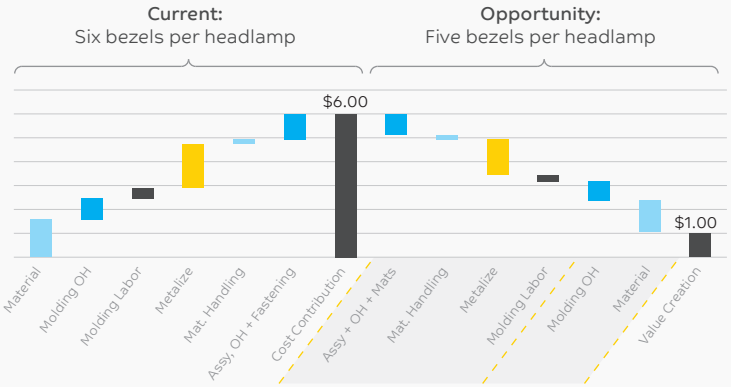
HIGH FLOW MATERIAL CAN MAKE THE DIFFERENCE

SABIC has developed a PC resin, which one can mold with a draft angle that is between 0.5 and one degree lower than the recommended PC draft angle of 3 to 5 degrees. An improvement of just 0.5 degrees can provide considerably more freedom for the design of headlamp bezels.

The material, LEXAN™ HF4010SR resin, incorporates an additive solution that is more effective than a standard internal mold release agent. The additive yields a material with a considerably lower coefficient of friction, which correlates well with the required ejection force.

In a value creation study, we calculated that use of a new PC material with improved flow could make it possible to produce a headlamp assembly with a reduced number of components combining many separate bezel elements.

Value Creation Study — LED Headlamp



Reducing the number of bezels from six to five in an LED headlamp can mean a cost savings of over one dollar (USD) per unit.

We determined that this level of parts integration could generate a cost savings of over one dollar (USD) per headlamp. This amount includes savings in materials, molding labor and overhead, metallizing, materials handling and assembly.

In addition, the higher flow of the material can make it possible to achieve a 1.5 millimeter (mm) wall thickness over a 400 mm flow length. Potential bezel weight savings can be up to 30 percent.

The higher flow of the resin comes without any loss in impact performance. In fact, this series of LEXAN resins can deliver twice as much flow with the same impact performance as LEXAN 121R and HF1110R resins from our portfolio.

Bezels that are injection molded in LEXAN HF4010SR can be directly metallized (no need for priming), and gloss and reflectivity

Potential bezel weight savings with the higher flow of LEXAN™ HF4010SR can be up to 30 percent

performance under high temperature conditions are both very good. The material has a wide processing window, high flow, and can produce parts for environments requiring a maximum constant use temperature of up to 130 degrees Celsius (266 Fahrenheit).

The unique flow properties of the resin allows the option to reduce the complexity of the tooling by filling the whole cavity of the mold with a single gate instead of hot runner systems, which can create knit lines and aesthetic issues in the final product.

Cost savings of up to 50 percent per bezel are possible – by avoiding complex tooling, enabling faster molding, enabling part integration and reducing weight.

With the increased styling capability made possible with a material like LEXAN HF4010SR resin, designers can dream up shapes that are more complex and incorporate greater integration of features and functionality.

Cost savings of up to 50 percent per bezel are possible with LEXAN™ HF4010SR resin

BEYOND THE MATERIAL

Of course, material selection is not the only factor in determining the draft angle. Wall thickness and depth, shrink rates, the desired finish and texture, and the manufacturing process also come into play. You must take all of these considerations into account in the design development process.

RECAP

- Greater styling freedom for the production of complex lighting components is possible with sharper draft angles.
- LEXAN HF4010SR resin from SABIC allows for a lower draft angle – making it possible to achieve complex three-dimensional shapes. The resin's high flow also allows for the use of simpler tooling, which can help avoid the appearance of knit lines and aesthetic issues in the final product.
- LEXAN HF4010SR with its high flow properties can enable optimized wall thickness for weight savings without compromising impact performance.
- Designers, engineers and processors should consider additional factors when determining the draft angle.

AUTO-AL-HF-001-EN-070319