



Plastic headlamp lenses reduce weight and reduce lens breakage, which can improve nighttime visibility and safety

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- Over the last decade, automobile manufacturers have focused on vehicle lighting improvements as a way to improve vehicle safety, as more than 60% of all traffic accidents took place in poorly lit conditions during that time period.¹
- The use of plastic in headlamp applications enables automakers to reduce weight without sacrificing optical performance while increasing resistance to breakage.²
- Glass headlamp lenses began to be replaced with polycarbonate ones in the 1980s.³ Today, virtually all glass lenses have been replaced by transparent polycarbonate plastics.⁴
- Plastic offers the advantage of being an inherently light material that can be easily made in thin sections and stepped shapes, reducing weight and the possibility of breakage “without sacrificing optical performance.”²
- The introduction of plastic headlamp lenses for US markets was pioneered by General Electric Miniature Lamp Division, which began manufacture of an all-plastic sealed beam unit in 1979 with a weight of less than 1/3 of the existing all-glass unit.⁵
- In measuring the weights of an average glass halogen headlamp versus a larger plastic halogen headlamp from a 1993 Dodge Caravan, the glass headlamp weighed 1 lb. 10.7 oz., while the larger plastic one weighed 1 lb. 1.1 oz.—a weight savings of 35.7%.⁶
- In addition, polycarbonate resin can be used for both the headlamp lens and housings, which are bonded together eliminating fasteners, gaskets, and attachment hardware (parts consolidation). “A significant weight savings accrues when the polycarbonate resin replaces the housing formerly in die cast zinc, as well as the screws and fasteners formerly required with the acrylic lenses.”⁷
- Using plastic in headlamps can also help avoid the safety issues caused by the hazardous breakage of glass.² In an extensive road test program carried out in the UK over a 20-month period, plastic and glass lenses were fitted side by side on the front of high mileage commercial vehicles below bumper level. While 60% of glass lenses were seriously damaged or destroyed, “none of the polycarbonate lenses suffered any major damage.”⁵
- Plastic’s versatility allows auto headlights to incorporate designs that can increase highway safety, such as high-tech focusing designs in the lenses.⁴
- Innovative headlamp technologies that increase illumination utilize plastic components as well. An LED headlamp recently developed by Volkswagen and Hella includes seven honeycombed plastic lenses, while a bi-xenon Saab headlamp (see photo on next page) necessitates the use of clear plastic lens covers which “are more resistant to stone chips and breakage as well as being lighter.”^{8,9,10}



The smaller glass halogen headlamp (left) weighs 1 lb. 10.7 oz. On the right, a larger plastic halogen headlamp for the 1993 Dodge Caravan weighs only 1 lb. 1.1 oz, for a weight savings of 35.7%.*

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Plastic helps make the pentagonal shape of the lenses used in the honeycomb-style Hella/Volkswagen headlamp possible.*

Additional Information

- The plastic resin used in headlamp applications has a good resistance to heat and cold, and a very optical clarity—"the resin is water-clear in its natural state."⁷
- Polycarbonate plastics can be molded into very complex shapes, producing smaller, more streamlined lights. This increased design freedom makes more aerodynamic shapes possible.^{11,12}
- Polycarbonate, sometimes used as a bullet-resistant glazing on other applications, has about 200 times the impact strength of glass. This strong, stiff, transparent thermoplastic can maintain rigidity up to 140° C (284° F) and toughness at -20° C (-4° F).^{13,14}

The Saab bi-xenon headlamp utilizes clear plastic lens covers which are more resistant to stone chips and breakage in addition to being lighter.*

*Information drawn from bullets.

Used with permission. Courtesy of Saab USA.



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Pictures

Plastic vs. glass headlamp: ACC Automotive Learning Center in Detroit, taken by Jim Kolb

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Saab bi-xenon headlamp: File e-mailed by Jan-Willem Vester, Saab USA

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