CASE STUDY: GAGGIONE S.A.S

Gaggione achieves breakthrough new collimator design using optical-grade SILASTIC™ MS-1002 Moldable Silicone

The challenge

Gaggione S.A.S., an innovative designer and manufacturer of advanced optical components, has earned a reputation for diligently evolving and expanding its LEDnLIGHT family of optical collimators to address the latest performance demands for solid-state lighting. Occasionally, it has found the demands of the market can challenge the limits of conventional optical materials. This was the case when Gaggione sought to develop two unique 32 mm and 67 mm circular collimators (Figure 1) for chip-on-board (COB) and other high-brightness LED architectures for lighting applications.

Figure 1: Gaggione's 32 mm and 67 mm diameter LEDnLIGHT collimators made of SILASTIC™ MS-1002 Moldable Silicone

One of the key challenges Gaggione confronted was that its collimator design incorporated a negative draft angle as well as variable wall thicknesses. Both of these features are difficult to fabricate using conventional thermoplastics or glass. In addition, targeted LED lighting applications demanded that the material deliver reliable mechanical and optical performance despite exposure to high lumen densities, outdoor ultraviolet (UV) light, external temperatures cycling between -40°C and 125°C, and internal module temperatures reaching as high as 110°C.

On top of all that, Gaggione has constantly sought material technologies that enable increased efficiency for its products through simple, cost-effective manufacture and assembly that lead to lower total cost of ownership for its customers.

The solution

The unique design of Gaggione's LEDnLIGHT collimator incorporated an internal concave cylinder shape (Figures 1 and 2) that precluded the possibility of using glass or conventional optical-grade thermoplastics, such as polymethylmethacrylate (PMMA) or polycarbonate (PC), in an injection-molding process. Consequently, Gaggione chose to design and produce its collimator using SILASTIC™ MS-1002 Moldable Silicone.

This optical-grade moldable silicone exhibits high flexibility to support easy demolding and long-lasting toughness of final optical parts. In addition, it delivers very low viscosity before cure, processes at room temperature and requires very low injection pressures compared to thermoplastics. Optics made of SILASTIC™ MS-1002 Moldable Silicone deliver outstanding mechanical, thermal and optical performance. The long-term stability of SILASTIC™ MS-1002 Moldable Silicone-based optics also has been proven in accelerated aging tests up to 6,000 hours at high temperatures (150°C), as well as in artificial sunlight (UV-A and UV-B) combined with heat (65°C). Optical grades of SILASTIC™ MS-1002 Moldable Silicone are therefore the materials of choice for any professional indoor and outdoor lighting application – particularly those where stability against high heat and light flux are important.

Figure 2: Gaggione's new circular collimator design with ray trace (right) and photometry simulation (left) with stray light combined with main light beam (center). Patent pending n°FR1452747.

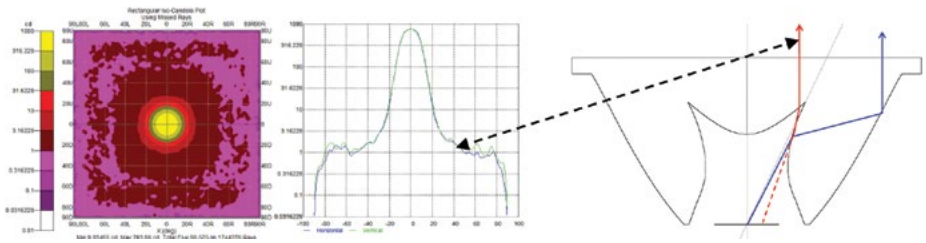
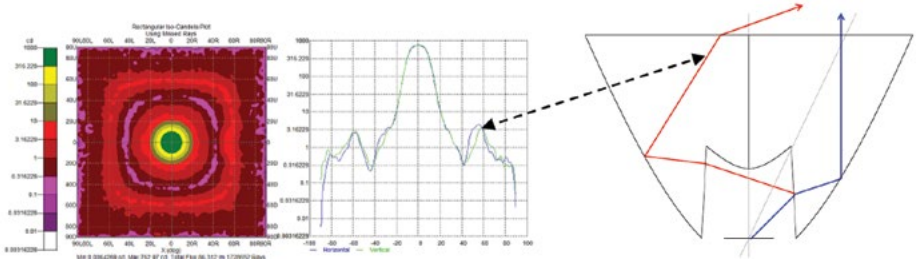


Figure 3: A classical circular collimator design with ray trace (right) and photometry simulation (left) with satellite stray light distinct from main light beam (center).



The success

With the help of SILASTIC™ high-performance material and technical expertise, Gaggione was able to achieve a negative draft angle and variable wall thicknesses for its breakthrough collimator design (Figure 2).

"As a designer and manufacturer of cutting-edge optics, Gaggione recognizes that advanced materials provide the foundation for innovation along the entire LED lighting value chain," said David Veryser, LEDnLIGHT commercial manager at Gaggione. "SILASTIC™ MS-1002 Moldable Silicone is more than an incremental advance in materials technology. It enabled an entirely new template for approaching optics design and opened the possibility for new concepts that were simply not possible with conventional thermoplastics."

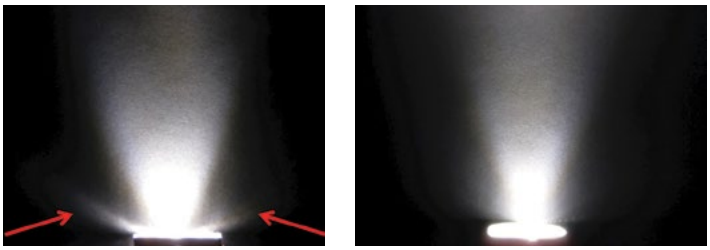
Gaggione found that the advanced optical SILASTIC™ MS-1002 Moldable Silicone material enabled more accurate photometry without parasitic light rays. The easily processable silicone, therefore, contributed to a more efficient and homogeneous light distribution (Figures 2 and 4) compared to classical lens designs made of PMMA (Figures 3 and 4).

The patented new collimator design also permits the use of larger, brighter COB light sources with optimal light output ratios. The images of projected light beams in Figure 4 offer a visual demonstration of the presence of satellite stray light to the left and right of a classical collimator design's center beam. Such stray light detracts from the efficient output of LED light sources, and it was minimized in Gaggione's innovative design.

Figure 4: Pictures of light beams from classical (top) and new (bottom) LEDnLIGHT collimator design. Light source was a CREE COB powered at 42 V/350 mA.

Classical design (PMMA)
Satellite stray light

New design (SILASTIC™ MS-1002 Moldable Silicone)
Smooth and straight light beam



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