

Makrolon® Polycarbonate for Outdoor Lighting Applications

Makrolon® LED lens grade materials combined with AURA™ UV infusion technology provide a cost effective durable solution

- **UV Resistance** – after processing by AURA UV infusion
- **Impact Resistance** – for rough service environments
- **Heat Resistance** – better retention of properties at elevated temperatures
- **Cost Benefit** – manufacturing and part performance



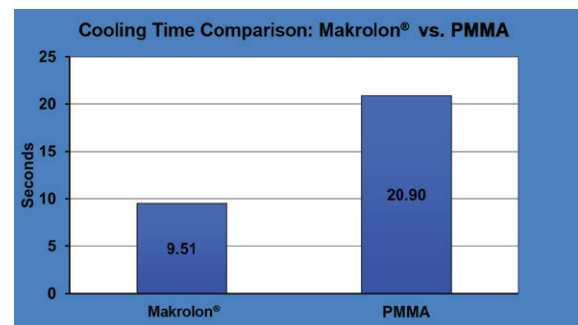
MAKROLON ADVANTAGES COMPARED TO PMMA (ACRYLIC)

MOLDING

- Better heat dissipation for shorter cycle times
- Higher index of refraction for thinner wall sections

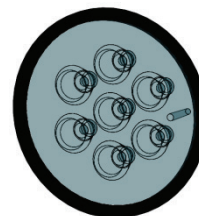
DESIGN & ASSEMBLY

- Resistance to stress cracking plus excellent ductile behavior
 - Reliable integration of components
 - Robustness for joining techniques such as snap fits

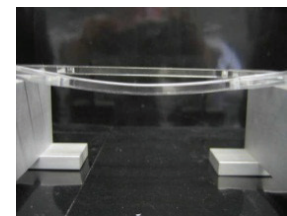


LONG TERM DURABILITY

- Excellent impact performance – up to 30x PMMA
- Retention of properties over a range of temperatures
 - Resistance to creep provides better long-term seal performance
 - Better fatigue resistance at elevated temperatures
- Dimensional stability with up to 25% lower thermal expansion and moisture absorption



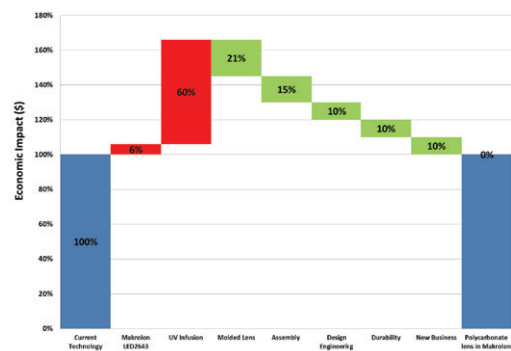
Makrolon Optics with Integrated Seal



Makrolon vs. PMMA after Heat Aging @ 85°C

MARKET OPPORTUNITIES

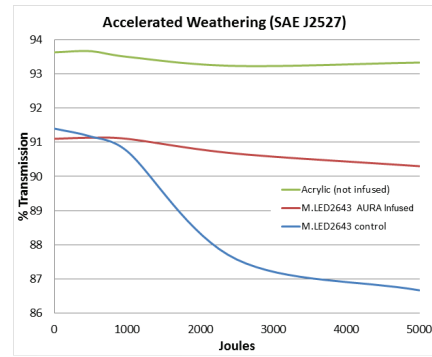
- UL 94 flame class ratings V-0 and 5VA
- UL RTI listings up to 125°C
- AURA UV infusion allows Makrolon to resist yellowing from long term UV exposure
- AURA UV infusion of Makrolon can provide a similar total cost as PMMA for optics, lenses, covers and enclosures



Aura™ UV Infusion Technology

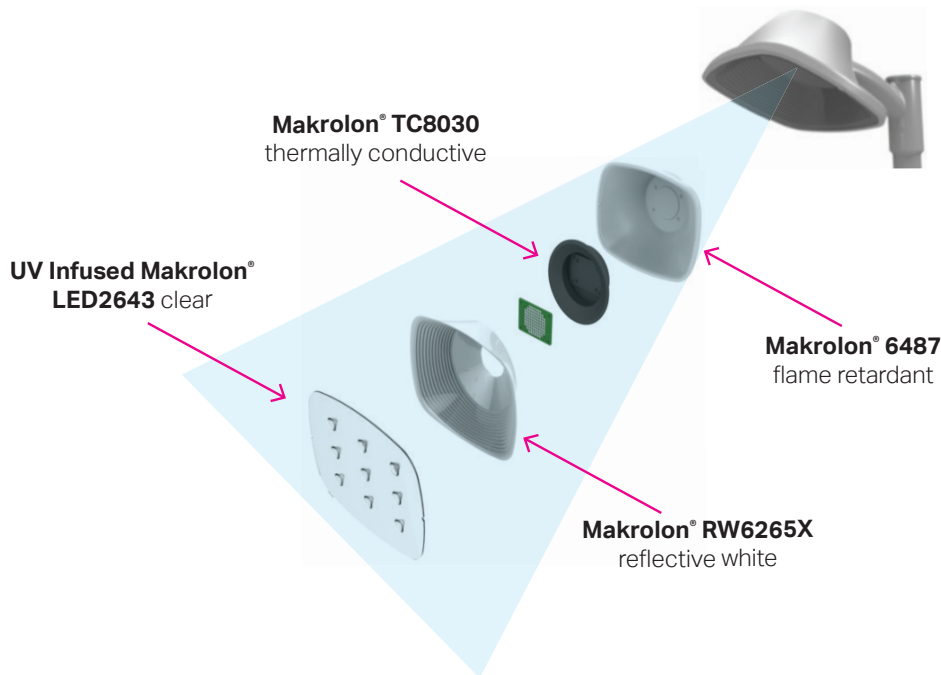
Ultraviolet (UV) light protection infused into Makrolon® polycarbonate provides many benefits:

- **Manufacturing Flexibility** – allows production of both UV and non-UV protected parts in the same cycle due to a post-molding process
- **Penetration Depth** – provides the material with UV protection even after surface damage
- **Minimal Change** – in yellowness index, light transmission and haze development
- **Product Life Extension** – through improved retention of color, clarity and optical properties



Infused Samples after 5000 Joules of UV Exposure

The Future of Lighting with Covestro



Covestro's product portfolio offers a variety of solutions for lighting OEMs, ODMs, custom molders and extruders



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