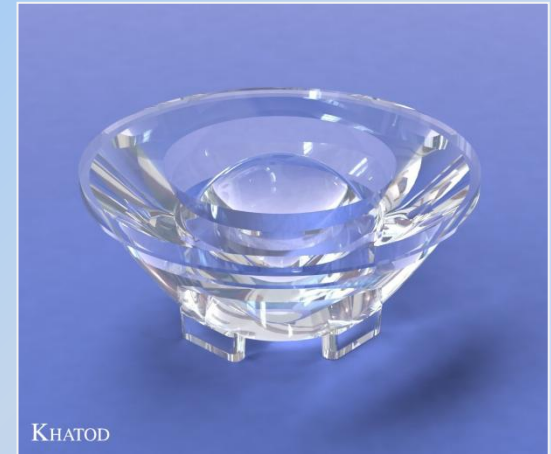


## **The New Frontier for Secondary Optics for LEDs now has a name: : PL50SIL by Khatod**

### **Why now a lens made of SILICONE?**

The LEDs of latest generation - High Brightness LEDs – achieve very high temperatures which could put strain on the conventional polymers such as PMMI, PMMA and PC.

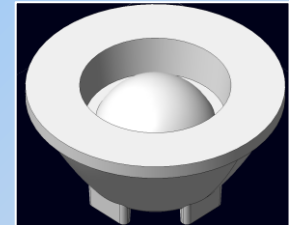
- Silicone is much more resistant to high temperatures.
- Silicone considerably reduces the yellowing effect, so making PL50SIL perfect for the outdoor applications. No extra protection, as for example glass in case of head-pole, and no gasket for IP insulation are needed.
- As an isotropic material, Silicone provides PL50SIL with high flexibility which allows an easy fit to the final application.
- As an elastomer, Silicone provides a perfect compensation for the construction mechanical tolerances typical of the final application.



## The New Frontier for Secondary Optics for LEDs now has a name: **PL50SIL by Khatod**

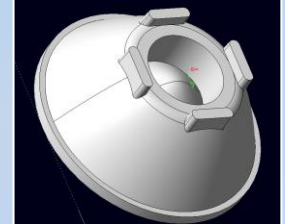
### Features:

PL50SIL -TIR (Total Internal Reflection) Lens, MR16, Ø 50mm - realized in Ultra Clear Silicone - engineered to meet the typical requirements of High Brightness LEDs on COBs (Chip On Board). This kind of elastomer has achieved a very high optical index, however not yet exactly like PMMI, PMMA or PC.



### How did Khatod meet the challenge?

- New optical techniques allowing to sharpen extreme angles and elaborate specific geometries have been developed in order to make PL50SIL able to achieve a superior optical refractive index : the optical performance level delivered perfectly complies with the optical efficiency requirements posed by the HB LEDs of latest generation.
- Also, cutting-edge engineering, advanced technologies customized by Khatod's engineers, continuous research and experimentation, have led Khatod to work out a totally new transformation process in the typical mould injection process .



## The New Frontier for Secondary Optics for LEDs now has a name: **PL50SIL by Khatod**

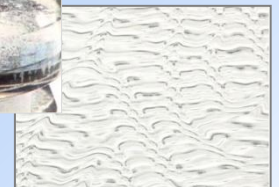
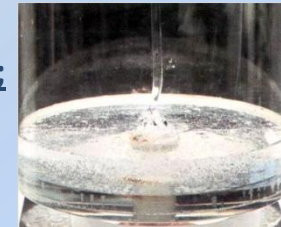
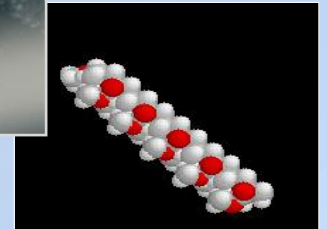
### Manufacturing Process:

The optical geometry being equal, the manufacturing cycle of a lens made of silicone is considerably reduced than the one of a lens made of conventional polymers (PMMA, PMMI, PC).

Cooling time takes up over 50% of cycle time and starts once the injection phase is finished : the hotter the melted plastics, the longer the cooling time, and the thicker the part produced, the longer the cooling time, resulting in some issues typical of this process.

### Injection Moulding

- When using Thermoplastic Polymers, being the material in granules , it needs to be injected HOT. The cooling takes place inside the mould, once the injection phase is finished: the thicker the part produced, the longer the cooling time.
- When using Silicone, being the material in liquid form, it is injected COLD; This results in significantly reduced moulding process time.



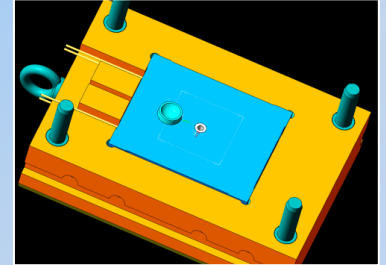
## The New Frontier for Secondary Optics for LEDs now has a name: PL50SIL by Khatod

### Cold Injection Moulding

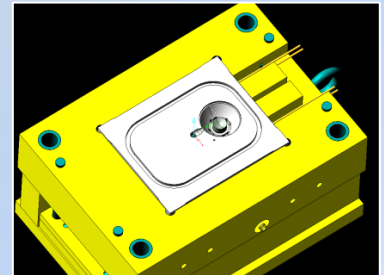
Cold injection moulding process needs a specific equipment, totally different from the traditional systems :

- Tooling must be accurate to one hundredth of a millimeter;
- The injection system is realized with innovative technologies never applied to the injection process before;
- The elastomer used to realize the silicone lens by Khatod is a bicomponent silicone that can be mixed only under specific conditions in order to realize such a lens.
- The mixing process conditions must be created perfect in order to meet the typical requirements of the elastomer selected.

### Mould Rendering



Fixed Part



Movable Part

## The New Frontier for Secondary Optics for LEDs now has a name: **PL50SIL by Khatod**

*About the Ultra Clear Silicone selected by Khatod for innovative optical applications by injection molding*

Excellent transparency, low absorption of light, high efficiency in light distribution

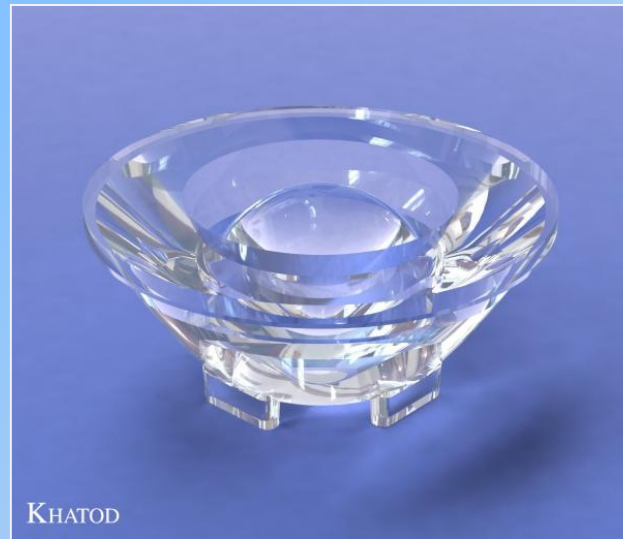
No birefringence

high thermal stability

UV-resistant, no yellowing effect

High flexibility even at low temperature

easy fit to the final application



Isotropic optical properties

fast cure

high flowability and low viscosity

High efficient injection moulding process

easy demoulding

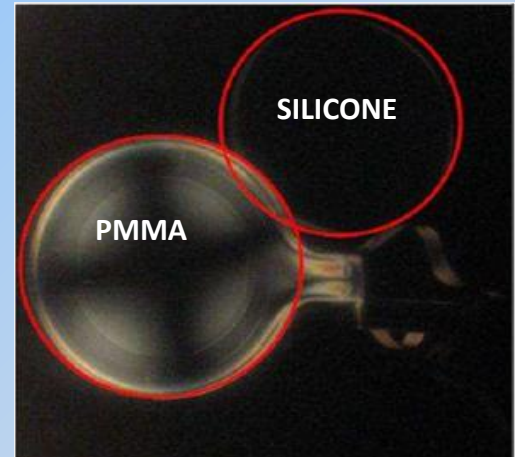
Reduces the manufacturing cycle; preserves and enhances the optical properties;  
Micro –Crack resistant also under harsh environmental conditions



## The New Frontier for Secondary Optics for LEDs now has a name: **PL50SIL by Khatod**

### Ultra Clear Silicone Performance

Ultra Clear Silicone Lens compared to PMMA Lens:  
isotropic optical properties of silicone, show no inner  
tensions (frozen effect lines) and no birefringence



PMMA



PMMI



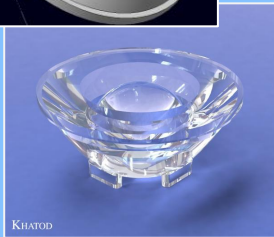
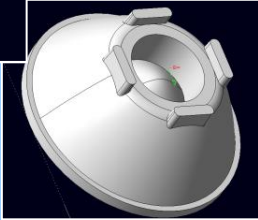
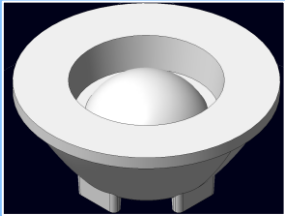
PC



SILICONE

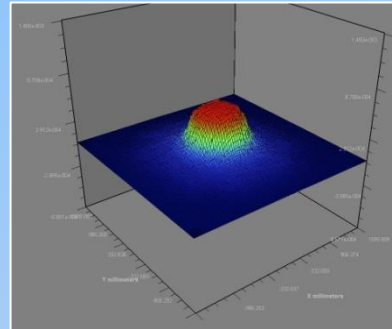
Ultra Clear Silicone compared to  
conventional thermoplastic polymers after  
exposure in hot air for 6480 h at 150°C.

Cutting-edge engineering, advanced technologies, continuous research and experimentation, have led Khatod to work out a totally new manufacturing process able to create the newest Lens in Silicone rubber perfectly meeting the typical requirements of High Brightness LEDs of latest generation:

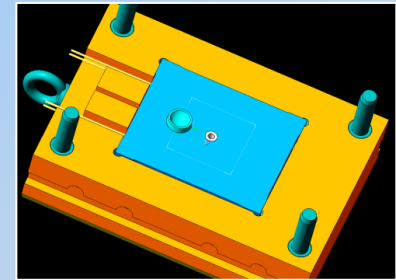


KHATOD

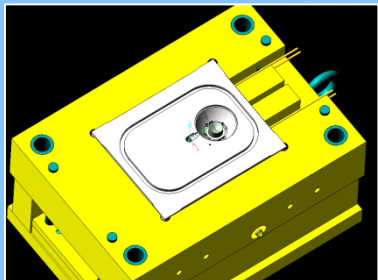
## PL50SIL by Khatod



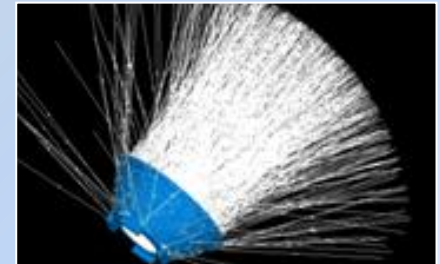
3D Spot of Luminous Flux through the lens



Transformation Process :  
Injection



Transformation Process :  
Demoulding



Luminous Efficiency : approx 90%

TIR, MR16,  
Ø 50mm, Lens for  
High Brightness LEDs  
on COBs - made of  
Ultra Clear Silicone