6 Best materials for illumination optics

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Selecting the right material for your application

Below is our list of the primary materials to consider when designing an illumination optic. For brevity we left out glass or crystal materials used with laser sources or specialty applications, But please reach out if you'd like advice on those materials.

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1st: PMMA (Acrylic)

93% light transmission

The most widely used optical plastic material is polymethylmethacrylate, also called PMMA, acrylic (Plexiglass and Acrilite are brand names)

Advantages: Low cost, easy mold-ability into any shape, high light transmission, "green" material characteristics and high UV transmittance.

Disadvantages: Reported yellowing under prolonged UV exposure, higher water absorption, and more easy scratched and less heat resistant than other plastics.

Production methods: Molding and extrusion for volume production, machining or diamond turning for prototyping

2nd: Polycarbonate PC

88% light transmission

Polycarbonate, also called PC or Macrolon and Lexan brand names.

Advantages: More scratch resistant than pmma, is harder, higher refractive index, easy for molding, lower water absorption, and higher softening temperature than pmma (130 C). Polycarbonate have very low UV transmission under 400 nm so is widely used for sports and outdoor safe-eye glasses.

Disadvantages : 5% less light transmission than PMMA, yellowing under prolonged UV exposure, not as "green", some toxicity and not suitable for several biomedical applications, higher birefringence, higher price.

Production methods: Molding and extrusion for volume production, machining or diamond turning for prototyping

3rd: Aluminum

87% light transmission

Polished aluminum or vacuum deposited aluminum onto a plastic or metal substrate

Advantages: Can be very low cost, used in very high volume low cost flashlights for example, molded base surfaces can be made in unique shapes for light control. Some client prefer the 'look' of a reflector.

Disadvantages: Less light control compared to a beam shaping TIR lens molded from PMMA or PC, less efficient than PMMA

Production methods: Molded plastic and vacuum deposition in high volume, polishing aluminium for lower volume

4th: Zeonex

90% light transmission

Zeonex is a type of Cycloolefin copolymer and is designed and sold by Zeon

Advantages High light transmission, very low yellowing under UV exposure, very low water absorption, high thermal resistance, softening temperature is 130-150 C, "green" material suitable for medical applications, low birefringence and high Abbe number, good chemical resistance.

Disadvantage Higher cost, single supplier

Production methods: Injection molding, diamond turning for prototypes

5th: Silicone

95% light transmission

Optical silicone resins made by DOW and others

Advantages: Suitable for medical use, high efficiency, good yellowing stability, higher temperature resistance up to 150 C, low viscosity curing which allow it to be easily molded in smaller parts like micro arrays.

Disadvantages: Fewer molding suppliers, higher material cost, no easy way to prototype

Production methods: Injection molding

6th: PMMI

93% light transmission

Polymethacrylmethylimid called pmmi or trademark is Pleximid. Similiar optical properties to PMMA

Advantages: Very high melt temperature with the higher efficiency than PMMA, used in projects with high thermal load

Disadvantages: Higher cost, fewer molding suppliers familiar with using material

Production methods: injection molding

Great performance needs the right material and the right design. We can help.

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