



Properties of lenses

Properties of lenses

Optical properties

Mechanical properties

Electrical properties

Chemical properties

Thermal properties

Abbe value

Reflectance

Refractive index

Absorption

Optical
properties

Abbe value

- ◆ **Definition** :- Reciprocal of the dispersive power of the material and gives a measure of the material ability to hold spectrum together
- ◆ The higher the abbe value less will be the transverse chromatic aberration at periphery
- ◆ The lower the abbe value, the more chromatic aberration will be characteristic of the lens.
- ◆ Used to calculate axial and transverse chromatic aberration

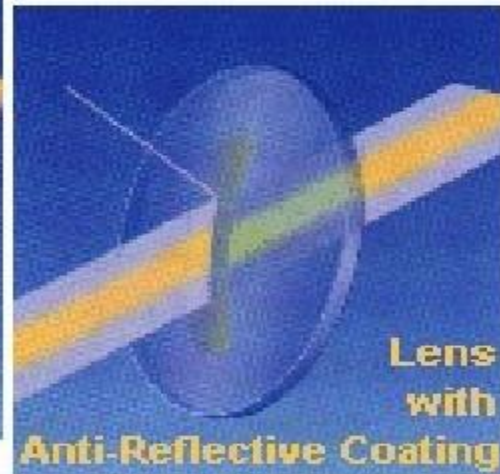
- ◆ Abbe number of 60 is considered to have the least chromatic aberrations and abbe number of 30 is for the most chromatic aberrations.
- ◆ When the wearer moves the eyes away from the centre and looks through the periphery of the lens, the prism is created
- ◆ Standard plastic lenses have an abbe value of 58.
- ◆ Most high index materials have a much lower Abbe value.

Material	R.I	Specific gravity	Abbe value
CR 39	1.49	1.32	58
CROWN GLASS	1.523	2.54	60
TRIVEX	1.53	1.11	43
MID INDEX	1.56	1.46	39
POLYCARBONATE	1.59	1.20	32
HIGH INDEX GLASS	1.70	2.99	32
HIGH INDEX PLASTIC	1.66	1.35	32

Reflectance

- ◆ Reflectance is the phenomenon of light reflection occurs at each of the lens surfaces.
- ◆ The result is the loss of lens transparency and undesirable reflections on the lens surfaces.
- ◆ The higher the refractive index, the greater the proportion of light reflected from the surfaces.

ANTIREFLECTIVE COATING



Refractive Index

- ◆ **Definition** :- the ratio of speed of light in a vacuum to the speed of light in a given medium
- ◆ *The higher the R.I. the thinner the lens can be made*
- ◆ If a material has a greater ability to refract light, less curve is required to obtain a specific power hence resulting in a thinner lens.
- ◆ Materials with an index between 1.523 and 1.57 are considered as mid-index, while 1.58 and greater is considered as high-index.

$$n = \frac{\text{Velocity of light in air}}{\text{Velocity of light in the medium}}$$

ABSORPTION

- ◆ The amount of light which goes through a lens can be reduced because of absorption by the lens material.
- ◆ This is negligible in case of a non-tinted lens, but constitutes an intrinsic function of a tinted or photo chromatic lens.
- ◆ Absorption of an ophthalmic lens generally refers to its internal absorption, i.e. to the percentage of light absorbed between the front and the rear lens surfaces.

Specific gravity

Impact resistance

Scratch resistance

MECHANICAL
PROPERTIES

Specific gravity

- ◆ **Definition** :- It is the ratio of 1 cubic cm of a material to 1 cubic cm of water
- ◆ The higher the specific gravity of a lens material, the higher will be the density and heavier will be the lens
- ◆ SG will give a rough idea about the relative weight of various lens
- ◆ It cannot accurately predict relatively weights of finished lenses as the denser material normally have higher R.I. and thus have a smaller mass.

Impact resistance

- ◆ Definition :- Relatively susceptibility of plastics to fracture under stresses applied at high speed
- ◆ Relative impact resistance of various materials will vary, depending on the size and shape of the missile used in the test
- ◆ The standard test employed by FDA involves dropping a 5/8 inch steel ball on to the lens from a height of 50 inches
- ◆ Polycarbonate and trivex are the most impact resistance followed by high index plastic lenses, CR-39, and finally the ordinary glass lenses.

Drop Ball Test

- It is an impact test in which a 5/8 inches steel ball weighted approx. 0.56 ounces (16 grams) is dropped from height of 50 inches upon the horizontal upper surface.
- The ball should strike within a 5/8 inches diameter circle located at geometrical centre of lens
- To pass the test/ lenses must not fracture means that the lens crack through entire thickness and across entire diameter up to 2 or more pieces or that lens material visible to the naked eye becomes detached from the optical surface.

- Each lens must be submitted to the drop ball test with exception of certain category lenses. Tolerance for when specified is +/- 0.3mm.

SCRATCH RESISTANCE

- ◆ One of the straight features of glass lenses is abrasion resistance.
- ◆ Plastic lenses need to be coated with an additional resin to approach the scratch resistance of glasses.
- ◆ These resin coatings can be applied in a number of ways.
- ◆ Lenses may be dipped, or a thin layer of resin may be spun onto the Lens surface.
- ◆ These coating layers are usually 5 micron thick.
- ◆ Abrasion resistance is an important property for spectacle lenses.

ELECTRICAL PROPERTIES

- Electrical properties characterize effects of electromagnetic waves and electricity on the materials.

CHEMICAL PROPERTIES

- ◆ Chemical properties shows the reaction of materials to the chemical substances usually found during lens manufacture, in every day life, or to certain extreme conditions to which materials can be subjected.
- ◆ These substances are usually hot or cold water, acids and organic solvents.

THERMAL PROPERTIES

- Thermal properties state changes of state and the effect of temperature on materials

- Therefore, a hypothetical ideal lens material from both the patient's and practitioner's point of view –
- A high refractive index
- with low dispersion,
- Unbreakable,
- Un scratchable
- low density,
- Available with aspherical surfaces in all multifocal form,
- Easy to tint
- inexpensive

◆ THANK

YOU