

OPHTHALMIC LENS MATERIALS

Much of the information here is taken from the very useful article, "The High Index Revolution" by Joseph L. Bruneni which appeared on page 41 of the April, 1992, edition of *Eyecare Business*.

Materials Available

The table below lists the important properties of the materials currently available for ophthalmic lenses.

MATERIAL	INDEX	SPECIFIC GRAVITY	v	FORMS AVAILABLE
crown glass	1.52	2.54	5.8	most lens forms
hard resin	1.498	1.32	5.8	most lens forms
glass	1.60	2.73	4.2	S.V. & fused bifocal
glass	1.70	2.99	3.2	S.V. & fused bifocal
glass	1.80	3.37	2.5	S.V. & multifocals
polycarbonate	1.59	1.20	3.1	S.V., aspheric, multicals, PAL
plastic	1.54	1.21	4.7	S.V., PAL, aspheric only
plastic	1.56	1.42	3.9	S.V., bifocals, PAL
plastic	1.57	1.17	3.6	S.V., aspherics
plastic	1.58	1.42	3.7	S.V., bifocal
plastic	1.60	1.34	3.7	S.V., aspheric, bifocal, PAL
plastic	1.66	1.35	3.3	S.V. (-10.00 & higher powers)



The index in the above tabulation is, of course, the index of refraction. Specific gravity is weight per unit volume so a given volume of crown glass of specific gravity 2.54 is $2.54 \div 1.32 = 1.92$ times as heavy as the same volume of hard resin of specific gravity 1.32.

Until about 1980 the mainstay of ophthalmic dispensing was the crown glass lens. Increasingly larger eye sizes have made the lighter hard resin lens the standard nowadays. Resin lenses weigh about half their crown glass counterparts. Glass lenses are used almost exclusively for patients who tend to scratch their lenses or who want photochromic tints.

Polycarbonate lenses are the standard for protective eyewear. The material is tough but easy to scratch and comes standard with a scratch resistant coating.

A number of high index glass and plastic materials are now available to give patients with high prescriptions thinner, more attractive lenses. To get a feeling for the improvement, let's approximate the edge thickness of 60mm diameter -8.00D blank for hard resin and for polycarbonate. Using the approximate sagitta formula,

$$\text{hard resin: } s \approx h^2 F / [2(n-1)] = (0.030m)^2 (-8.00D) / [2(1.498-1)] = -7.2\text{mm}$$
$$\text{polycarbonate: } s \approx h^2 F / [2(n-1)] = (0.030m)^2 (-8.00D) / [2(1.59-1)] = -6.1\text{mm}$$

If we use the standard dress lens center thickness of 2.2mm, the hard resin lens has edge thickness of 9.4mm. But polycarbonate may satisfy dress thickness requirements when it is only 1mm thick, so the corresponding polycarbonate lens would have an edge only 7.1mm thick, about one fourth thinner. The decreased thickness coupled with polycarbonate's lower specific gravity would make the polycarbonate lens **much** lighter than the hard resin lens.

Another approach to edge thickness is the use of aspheric lens surfaces. The *Cosmolite™* lens, for example, uses asphericity to produce a very acceptable high plus lens with thinner edges and decreased magnification of the eye.