New High Index Glasses

Since the early 1700's, when Hall and Dollond started making doublets by combining crown window glass and flint tableware glass, the development of new glass types has been enabling an ever-widening array of new lens types. This year has seen the introduction of at least ten new glass types already, some of which are quite significantly different from existing available glasses.

Optical glasses have many properties of interest, such has index, dispersion, partial dispersion, transmission spectrum, melting point, and cost, just to name a few. The greatest areas of development for new glasses seem to be high index glasses, low Tg glasses which can be easily molded, and glasses with excellent transmission in the blue and UV end of the spectrum for life-science applications.

Figure 1 shows the upper right corner of the Abbe diagram for optical glass, which maps "common" glasses with an index (n_d) greater than 1.90 versus their Abbe number, or dispersion (V_d). Schott glasses are shown in blue, and Ohara glasses are shown in green. The one purple glass is made by the Chinese glass supplier, CDGM. Of the nine glasses in this chart, over half were released in the last five years. Not all these glasses are produced regularly, and many are only available in smaller sizes; check with your glass company representative for more information.

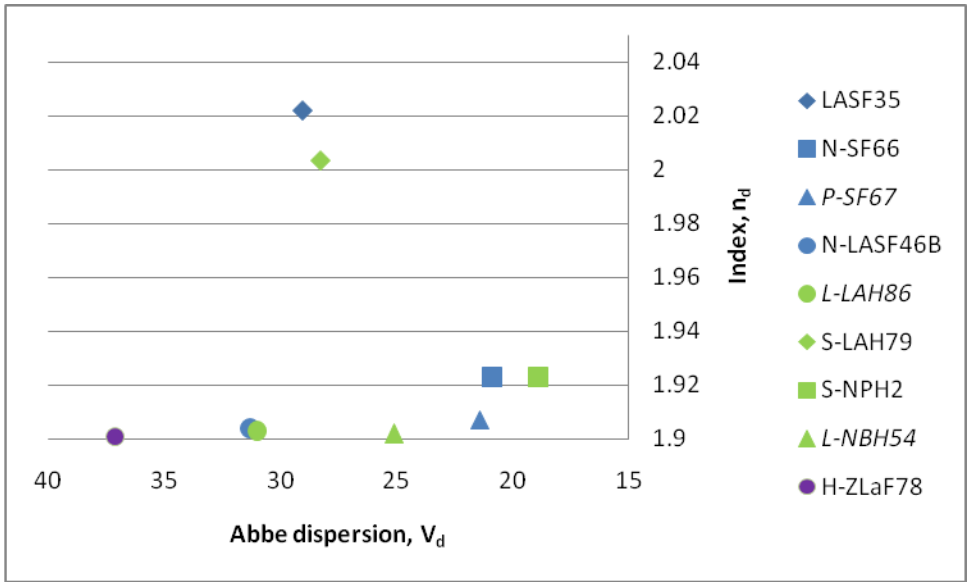

Figure 1. Abbe diagram of high index glasses with n_d greater than 1.900. Low Tg glasses are shown in italics. LASF35, L-LAH86, and N-LASF46B were all released in the past year.

One important attribute of a glass is the melting temperature, or Tg. Most older high-index glasses, like S-NPH2 or N-SF66, have a Tg of 650 or 700 degrees C. Many of the new glasses, however, like Ohara's L-LAH86, released last year or Schott's P-SF67 released in 2006, have a Tg of 580 or less, which make them good candidates for molded lenses.

If index is all that matters, then Schott's new LASF35, released in May is the glass for you. At an index of 2.022, it has taken the prize of the highest index optical glass away from Ohara's S-LAH79, which came out in 2002. According to Rob Lee of Ohara, though, L-BBH1, with an index of greater than 2.1, is due out later this year. And it's going to be a low Tg glass as well.

The Abbe number of a glass is inversely proportional to its dispersion, another very important property of optical glass. In many applications the performance of a glass is limited by its dispersion, so trading off a little index for a lower dispersion glass like CDGM's H-LaF78, introduced this spring, or Ohara's new L-LAH86 is appropriate.

Selection of glass types is an extremely important part of the optical design process, and chances are that for most applications, the use of the RoHS compliant equivalent of the old common glass types is the most cost-effective approach. After all, none of these glasses come cheap; prices for high-index materials are typically 10-15x that of common crown glasses, and fabrication costs are often much higher. But in some applications, the availability of new high-index glass types will be a significant factor in enabling new optical solutions.