High Optical Speed Filters

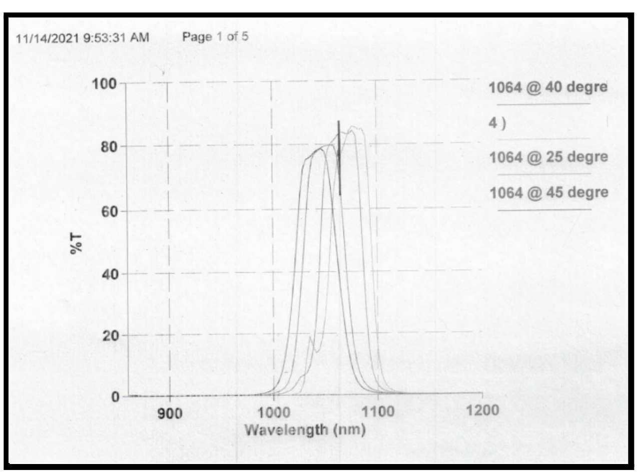
A principal limitation to the use of optical filters is that they are most effective when used in a collimated beam of light. This requires that for optimum performance the filter can not accept a wide field of view.

To address this limitation, an optical system must precondition the signal being analyzed so that the light is brought to a location where the rays of light are brought to a near parallel beam. This is especially true if the signal to noise must be maximized. Achieving this requirement expands the physical space needed for the optical system.

These limitations are somewhat moderated if the optical filter can be made with the highest effective index of refraction. In the visible the materials available have a practical limit of an index of about 2.0. This is essentially the upper limit of materials of the refractory oxides of metals, commonly used for hard surface coatings.

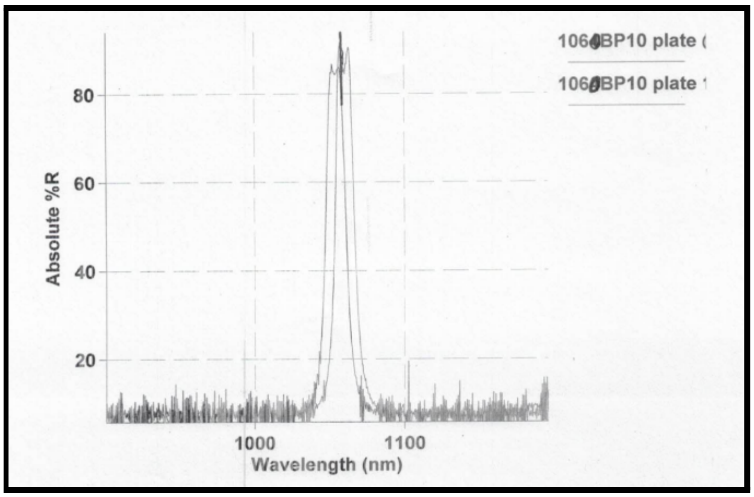
Opportunities open in the near to far IR, with the availability of higher refractive index semiconductors. From the NIR of about 800 nm to longer wavelengths, refractive index values of 3.0 to 4.0 are available in many materials. It is quite possible to increase the effective index to 3.0 or possibly even greater.

With these high index designs, the behavior of a filter opens. As an example, the deposition in Graph 1 shows a filter with a FWHM of 40nm at 1064 nm, that has an effective index of 3.0. This filter can pass light from normal to +- 40 degrees with virtually no decrease in throughput.



Graph 1

Example 2 is a filter of 10 nm FWHM at 1060 of 10 nm and can accept light from 0 to + 20 degrees with very little loss in performance. Both examples are quite thin coating with little stress, and the bulk absorption of the materials provide a free spectral range of DUV to >> 1200 nm with an average of OD 6+.



Graph 2

Check with RSS for available material for your next experiment.