Chapter 3

Filters, Prisms, Gratings, and Lenses

The optical system of any instrumentation utilizing radiant energy for analytical purposes includes some device to isolate the spectral region desired together with other optical devices to direct and focus the radiant energy. Spectral isolation is achieved by using a filter, a prism, or a grating, depending on the degree of wavelength resolution required. The collection and focusing of the light from the source are usually accomplished by using lenses and/or mirrors. Since careful control of the light path is needed to achieve maximum efficiency, an optical bench frequently is used to mount the parts of the optical system.

1. FILTERS

1.1 Absorption Filters

The simplest device used to isolate a spectral region is a color filter. The three main requirements of a filter are (1) high transmittance in the desired wavelength region, (2) low transmittance at all other wavelengths, and (3) a narrow wavelength band in the high-transmittance region. A number of other interdependent factors are involved in a useful color filter, including the spectral response curve of the detector, the intensities and bandwidths of the emissions to be measured, and the possibility of interferences in the spectral region transmitted by the filter from emission of elements other than the desired one.

Commonly available color filters have relatively wide spectral bandwidths. Widths of 350–400 Å are common, measured at a transmittance of one-half the maximum. The most suitable filter is that which has its maximum transmission at the desired wavelength and a small spectral bandwidth at
FIGURE 3-1. Characteristics of a light filter.

FIGURE 3-2. Combination of two light filters to isolate a spectral region.