B. Lead and cadmium in optical filter glasses

1) Importance of cadmium- or lead-containing filter glasses for medical-use endoscopes (and surgical microscopes and colposcopes)

There is an increasing demand for fluorescence observation and specific wavelengths for tests using endoscopes, as in the case of microscopes. These demands are met by means of xenon light and halogen light sources, selection of specific wavelengths using various filters of 340nm to 1100nm, and combination of high-transmittance glass fiber. Cadmium (Cd) is indispensable to obtaining the specific wavelength. The color reproducibility of silver-salt film photographs that are recorded using endoscopes varies depending on the type of silver-salt film. In order to achieve consistency in the color reproducibility of different types of films, a filter glass for correcting these differences is necessary (Fig. 1).

As another application example, if a green illumination light is used to observe a blood vessel during blood vessel emphasis observation using colposcopes, a darker emphasized observation image is obtained because blood possesses the characteristic for absorbing green light. A filter glass is required to produce this green illumination light. (Fig. 2) These filters have to contain lead to stabilize the pigments and reduce the melting temperature so that a high-quality filter can be manufactured.

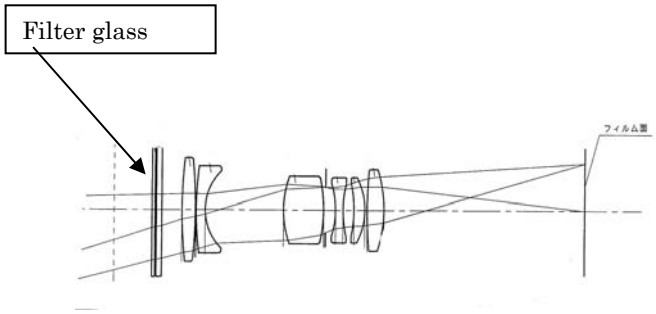


Fig. 1 Filter used for recording photographs using endoscopes

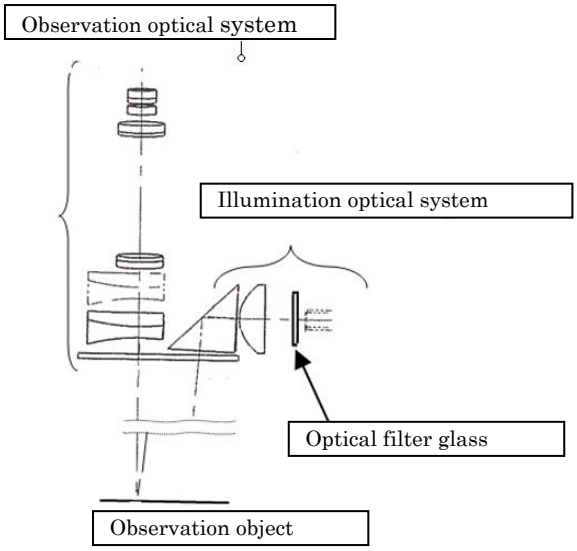


Fig. 2 Filter used during blood vessel emphasis observation

2) Importance of optical filter glasses of IVD analyzer

Clinical tests are performed for patients (including health diagnosis of a healthy person) as a means to obtain information that is crucial to a doctor for diagnosis, deciding a treatment, and determining a prognosis.

For a biochemical response and immune chemical response using a patient's urine and blood among specimen tests for analyzing patient samples (specimen), an accurate measurement of the color (intensity of absorption light produced by reaction) and clouding (density of clouding produced by reaction) is required using the absorption light characteristic generated as a result of the reaction. When such specimen tests are conducted, the function of the optical filter glass that transmits only light of a specific wavelength is important.

For example, the light-receiving device of a biochemistry analyzer (Fig. 3) must have the capacity to perform measurements that cover a wide wavelength range, for the equipment in general. For a target item, however, the capacity to eliminate lights other than the specific wavelength for a chemical substance is required.

The light-receiving device (as shown in Fig.4) contains a closely arranged photo detector called a photo diode array. Therefore, if sharp filtering is not achieved, the measured data becomes unreliable and the essential function of the clinical tests is compromised.

At present, only a photo diode array that uses optical filter glasses using sharp cut characteristics produced by the intrinsic absorption of the elements of cadmium and lead can achieve this characteristic.

Therefore, cadmium and lead are essential for the optical filter glasses of IVD analyzers.

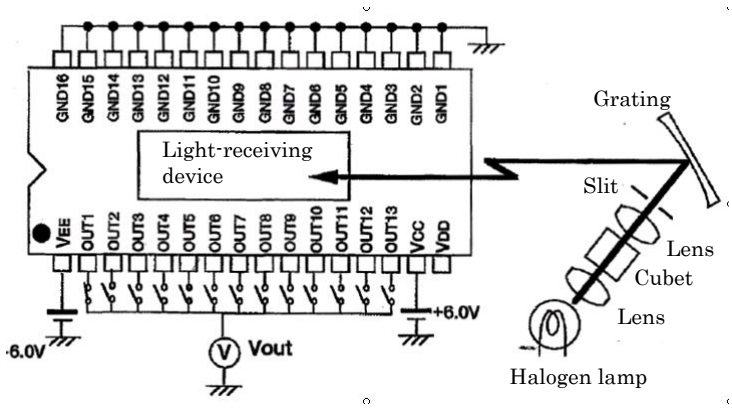


Fig. 3 Measurement unit of biochemistry analyzer

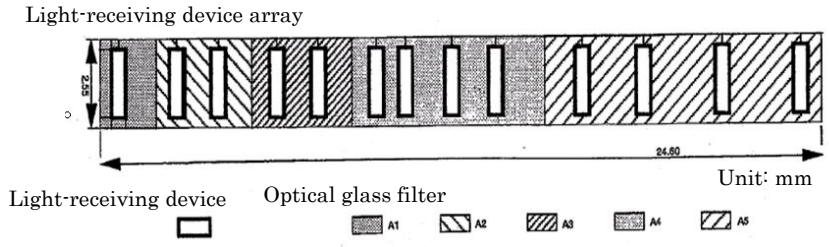


Fig. 4 Diagram of light-receiving device

3) Importance of optical filter glasses (Cd filter glasses) of microscopes

Many filter glasses (optical filter glasses) are used for various sections of a microscope. The emission filters (also called barrier filters or absorption filters) used for fluorescence observation (illustrated in Fig. 5) is a section that cannot be replaced with interference filters. Since fluorescence transmitted from the subject of fluorescence observation is extremely faint, the image contrast will be poor unless the scattering of excitation light is blocked sufficiently, making it difficult to detect the weak fluorescence.

If an interference film filter is used for emission filters, the scattering of excitation light that enters the emission filter at an angle cannot be blocked because of the incidence angle characteristic of interference film filters. As a result, an image with excessive background illumination (as shown in Fig. 6, (A)) is produced. On the other hand, optical filter glass filters use the intrinsic absorption properties of the element contained in a glass material. Therefore, even when the angle of incidence changes, the scattering of light is blocked sufficiently, an image with a dark background (as shown in Fig. 6, (B)) is produced, and even the extremely faint fluorescence can be observed. Consequently, the observation of extremely faint fluorescence will be impossible without the use of optical filter glass and this will significantly affect the progress of life science researches such as the genetic research shown in Fig.7.

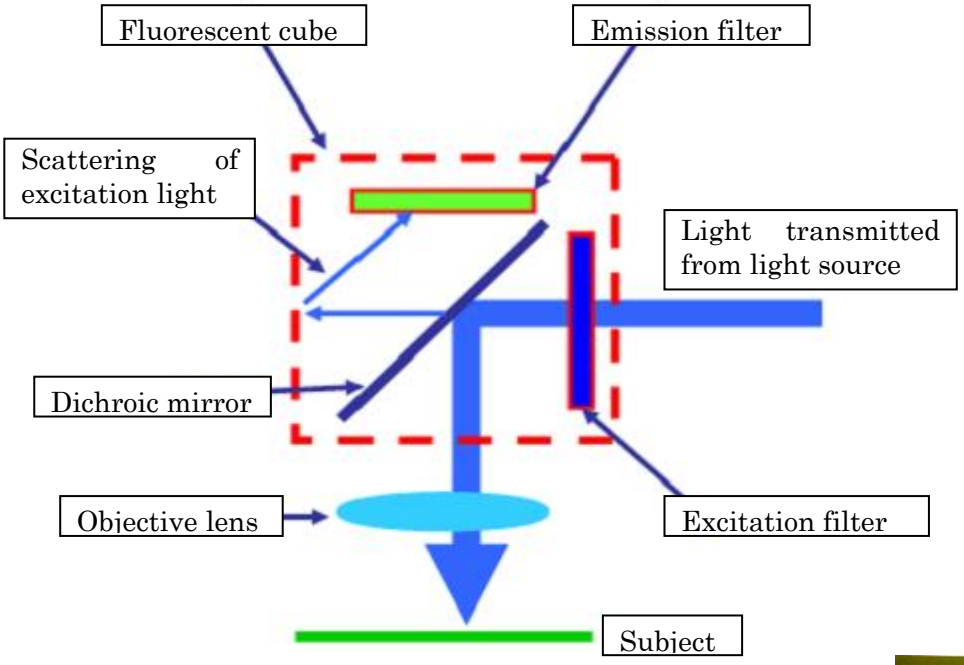
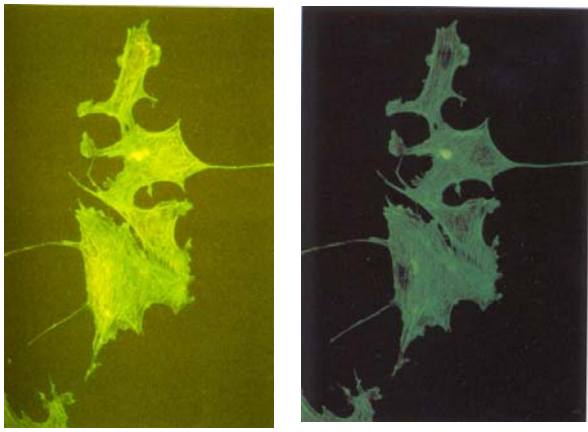


Fig. 5 Emission filter used for fluoresc

Cadmium (Cd) is absolutely necessary to achieve the sharp-cut properties of glass. The cadmium in glass possesses sharp-cut properties because of its intrinsic absorption characteristics, and therefore, there is no substitute for this substance.



(A:Left) Interference filter
Excessive background illumination

(B:Right) Optical filter glass

Fig.6 Difference in fluorescence observation images produced by different filters

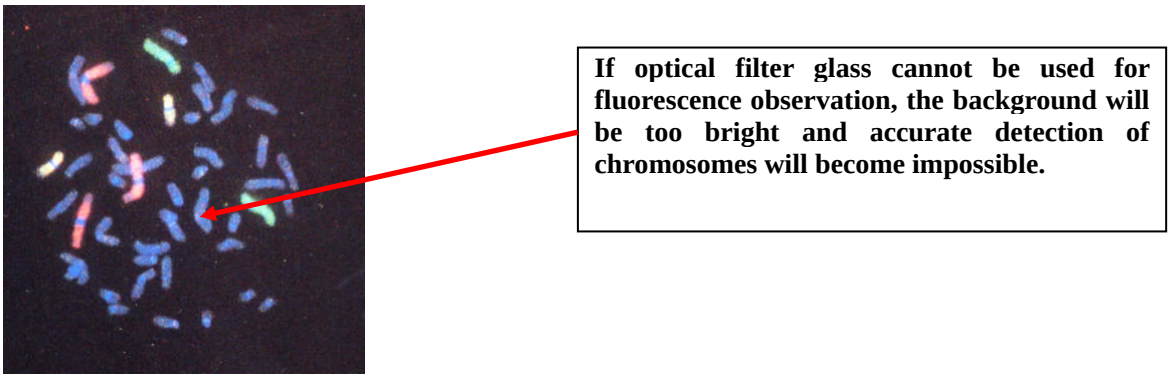


Fig. 7 Fluorescence observation image of chromosomes used for genetic researches