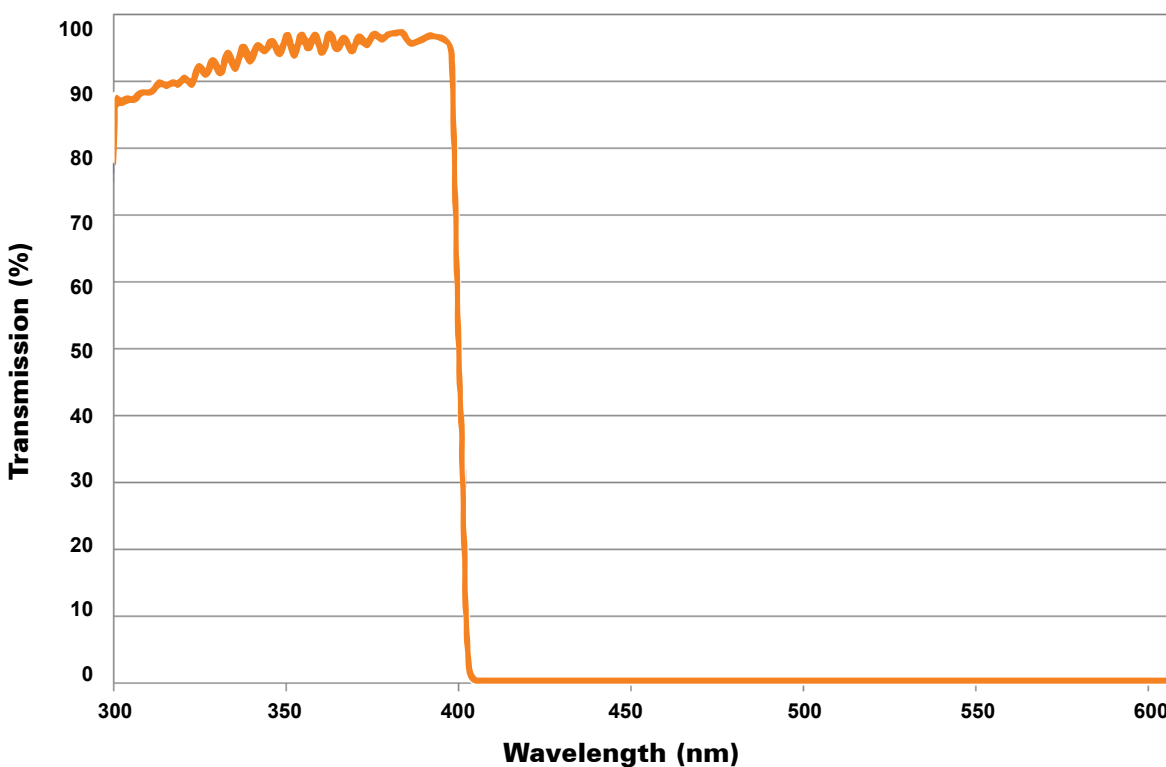


3.3 Other optical filters

Apart from the optical filters already described, there is a wide variety of other filter techniques available for optimising the test object image.

1. Shortpass filters

Shortpass filters transmit wavelengths that lie below the filter's threshold wavelength. Wavelengths above the threshold wavelength are attenuated. Shortpass filters are frequently used to separate wavelengths from one another and increase contrast in the image.



They can also be used as lighting filters in fluorescence applications. If a shortpass filter of this kind is used with a very sharp slope as a replacement for the bandpass filter described in chapter 3.1, then a similar effect can be achieved.

When combined with an appropriate longpass filter, a special kind of bandpass filter can also be generated.

Influence of the lighting angle

Wavelengths

Optical filters

Flash vs. continuous

Fluorescence applications

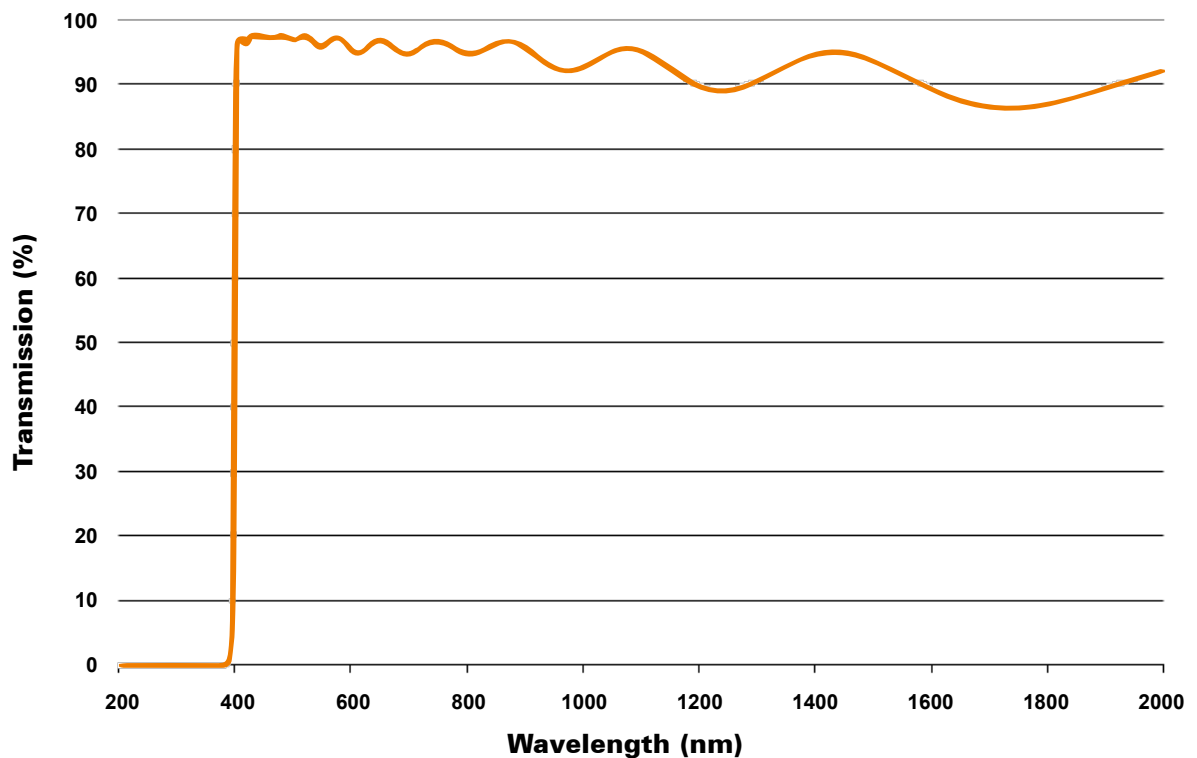
Lighting systems for the reading and verification of codes

Lighting technology for shape-from-shading

3.3 Other optical filters

2. Longpass filters

In contrast to shortpass filters, longpass filters transmit wavelengths above the threshold wavelength. As with shortpass filters, longpass filters can be utilised to separate wavelengths from one another.



In fluorescence applications, for example, longpass filters can be placed in front of the lens, so as to attenuate the excitation wavelengths and thereby increase image contrast. For more information, see chapter 5.

Influence of the lighting angle

Wavelengths

Optical filters

Flash vs. continuous

Fluorescence applications

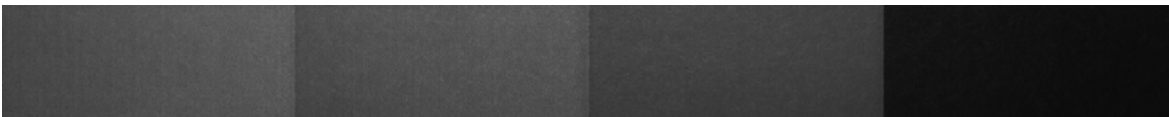
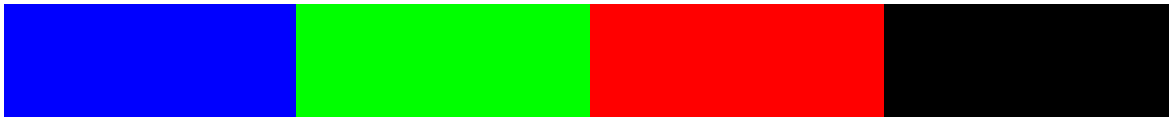
Lighting systems for the reading and verification of codes

Lighting technology for shape-from-shading

3.3 Other optical filters

3. Colour filters

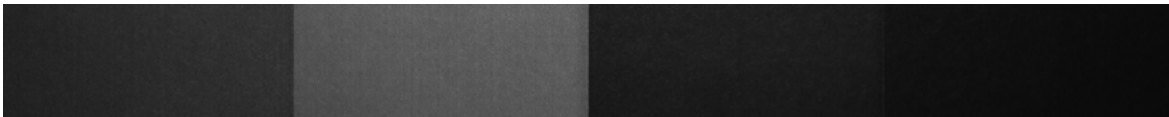
Colour filters are often used in conjunction with monochrome cameras. They are useful tools for increasing image contrast and separating, enhancing or suppressing certain colours. Colour filters are bandpass filters that transmit a specific colour band. If a red colour filter is used, for example, then red light is transmitted while other wavelengths are attenuated. Back in chapter 2.3, we looked at the interactions between coloured objects and visible light: an object reflects certain wavelengths and therefore appears coloured to the human eye. An object that we perceive as red therefore reflects the red portion of the light. Other wavelengths are instead absorbed. This particular mechanism can also be exploited when working with colour filters. If we use a colour filter in the same colour as the object, the object appears bright in the image. However, a colour filter in a different colour will make the object appear dark.



Imaged using white lighting with a monochrome camera



Red colour filter



Green colour filter



Blue colour filter

For details of the functionality provided by bandpass filters and their applications, see chapter 3.1.

4. Neutral-density filters

Neutral-density (ND) filters reduce the amount of incident light and are used to avoid overexposure effects in the image. These filters reduce light uniformly across the entire spectrum, and the use of a neutral-density filter has no effect on the representation of light colour or object colours.

Influence of the lighting angle

Wavelengths

Optical filters

Flash vs. continuous

Fluorescence applications

Lighting systems for the reading and verification of codes

Lighting technology for shape-from-shading