TN2015-02: Antireflection Coatings

Uncoated optical surfaces reflect a percentage of the incoming light with the exact amount dependent on the refractive index of the substrate material (see TN2014-03). In optical systems containing a large number of substrates, the various orders of reflection can thereby drastically reduce the contrast of any projected image. This is illustrated below in image 1.

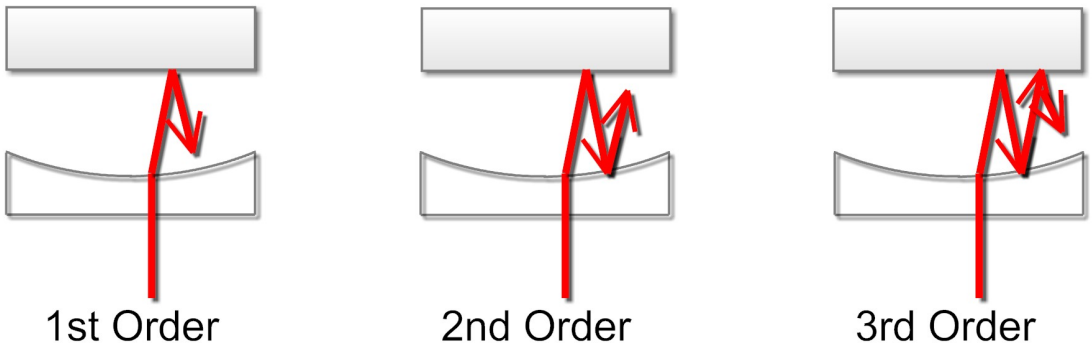

Image 1: order of reflection

The 1st order reflection reflects (depending on the refractive index) approx. 4% of the light, the second order 0.16% and the third order 0.0064% of the total. At the same time, the number of possible reflex images ('ghosts') increases steadily with the number of surfaces.

The reduce this effect, an anti-reflection (AR) coating can help. The most basic antireflection coating consists of a single layer of low refractive index dielectric material. Depending on the refractive index ratio between coating and substrate materials the reduction in reflectivity, at least for a single wavelength, can be significant, but the best choice is usually a two to three layer dielectric coating. Due to the spectral performance these coatings are also often called 'V-coatings'.

Image 2 illustrates how the reflectivity of an uncoated BK7 surface can be reduced by single layer and V-coatings.

Depending on the required application, antireflection coatings can cover a single wavelength, multiple wavelengths (for example, a number of laser lines) and a broad bandwidth (for imaging applications, for example).

As a general rule of thumb, the more wavelengths need to be covered or the broader the required bandwidth for the AR coating is, the lower the specification has to be.

As the coating materials are dielectric, the performance of an AR coating is also dependent on polarisations and therefore the angle of incidence.

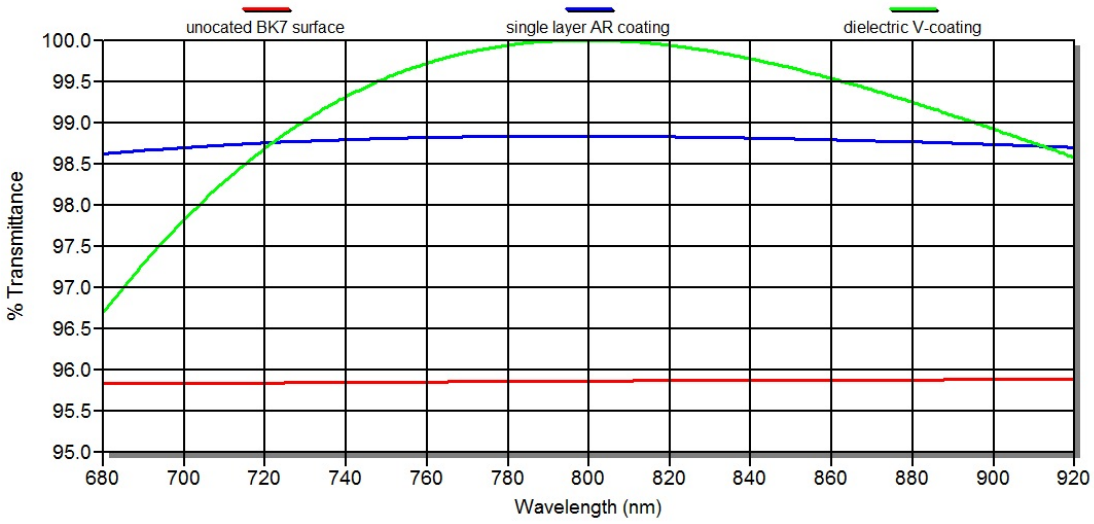

Image 2: Uncoated and coated BK7 surfaces in comparison

Furthermore, the refractive index of the substrate material is important. Where an AR coating for several different substrate materials is required, the highest performance will be achieved with AR coatings designed specifically for each substrate material. This, however, can be very expensive and very often it is possible to find suitable solution by designing an optical coating that can be applied to different substrates at only limited reduction in performance.

At Manx Precision Optics Ltd. (MPO) we have got vast experience in AR coatings and are always happy to work with our customers in finding the best solution. We manufacture traditional e-beam and sputter coated AR coatings. The latter are very often the coating of choice for machine vision applications and to enable rapid prototyping, MPO can offer a quick turnround (3-5 working days) on many substrate sizes and wavelength ranges while also offering highly competitive pricing.

For further information, please do not hesitate to contact us.

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