



Distinctness of Reflected Image (DOI)

Background

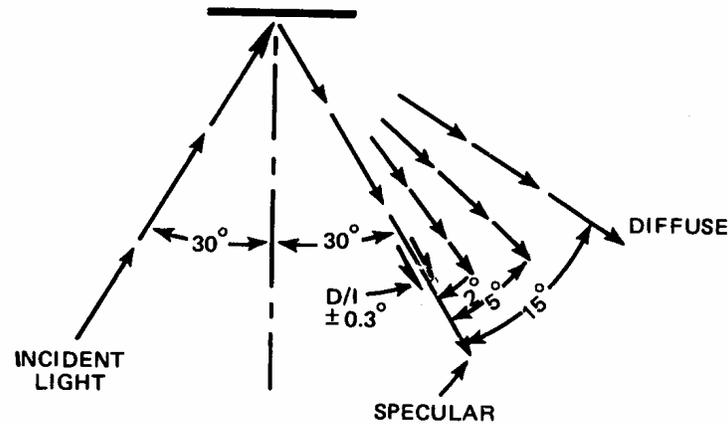
Distinctness of reflected image, or DOI, is a quantification of the spread of light reflected at the specular angle. It gives an indication of how sharp the image reflected by an object is likely to be. It goes a step beyond just how much gloss (specular reflection) is present by indicating how that light is distributed around the specular angle. For example, a product with a shiny surface may be flat and smooth, giving a very distinct sharp image. Another batch of that same product may also be flat, smooth, and yield the same gloss values as the first, but give a fuzzy or distorted image. For this example, DOI values would give a better indication of the product surface quality than gloss values.

DOI instruments measure in a manner similar to gloss instruments, by projecting light onto a surface at a particular angle. The reflected light is collected at the angle equal to but opposite the normal in a very narrow band. Measurements are also made slightly “off” from this narrow band to determine how much the specular reflection is spread.

The light reflected at the specular angle is expressed as R_s . This R_s value and the R_s value at the point slightly “off” the specular angle are used to calculate DOI.

DOI instruments normally measure reflected haze as well. The angles commonly used for this type of haze measurement are 2° , 10° , and 15° .

A DOI instrument has the general configuration shown below. This diagram is taken from Richard S. Hunter and Richard W. Harold, *The Measurement of Appearance*, New York: John Wiley and Sons, 1987, page 286.



Conditions for Measurement

Instrumental: DORIGON II. This instrument is no longer manufactured by HunterLab.

Formulas

$$R_s = \frac{R_{s \text{ sam}}}{R_{s \text{ std}}}$$

$$\text{DOI} = 100 * \frac{R_s - R_{0.3}}{R_s}$$

where

R_s is the light reflected at the specular angle

$R_{0.3}$ is the light reflected 0.3° “off” from the specular angle

$R_{s \text{ std}}$ is the R_s value for black glass when measuring nonmetals and a mirror when measuring metals.

Typical Applications

DOI is typically measured for materials such as car finishes, mirrors, and reflective lighting fixtures. R_s itself is often used in conjunction with DOI values. Reflected haze is typically used as a measure for surfaces with nominally clear coatings, brushed metals, or similar products.

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