

Understanding Appearance Measurement

Introduction

Product quality is what consumers consider when making purchases and the appearance of a product is often used as an indicator of quality. A product appearance involves not only color, but also attributes such as gloss, haze, orange peel and reflected image quality.



subtle textures not noticed by a gloss meter.

The two panels in Figure 1 shows big contrast between their appearance, but marginal difference in their gloss.



Figure 1 – Panels showing big difference in their appearance but little difference in gloss

Gloss

Gloss, expressed in gloss unit (GU), is measured by quantifying the amount of light that is reflected off a surface. The commonly used geometries for gloss are 20°, 60° and 85°.

To determine which geometries are more applicable, surface should first be assessed using the 60° geometry. Thereafter, readings below 10 GU or above 70 GU are recommended to be measured again using the 85° or 20° geometries respectively.

	Panel A	Panel B
Gloss – 20°	85.6	84.0
Gloss – 60°	95.2	91.3
Gloss – 85°	97.3	96.6

This example demonstrated the use of gloss to evaluate appearance is inadequate.

GU @ 60° < 10 GU	Low gloss	85° geometry
GU @ 60° = 10 to 70 GU	Medium gloss	60° geometry
GU @ 60° > 70 GU	High gloss	20° geometry

A comprehensive [appearance quality evaluation](#) can be obtained using additional parameters like Haze, Distinctness of Image (DOI) and Reflected Image Quality (RIQ).

Limitation Of Gloss In Appearance Evaluation

Historically, gloss measurement is the most widely used technique for surface appearance quality evaluation. However, two surfaces can have similar gloss readings yet very different visual appearance.

This is due to the [limitation of gloss meter technology](#); the cones in our eyes allow us to see

Haze

Haze, or [reflection haze](#), is caused by the micro textures on a coated surface changing the direction of reflected light adjacent to the specular angle.

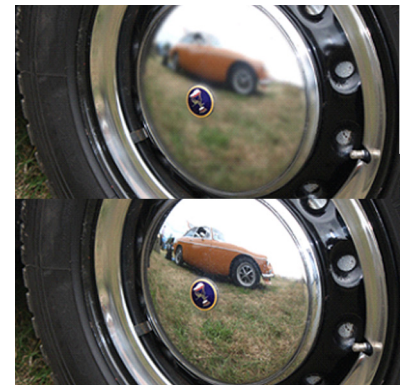


Figure 2 – Example of coated and polished surface with and without and Haze

Understanding Appearance Measurement

Reflection on surfaces with haze are visibly shallower. In addition, halos can also be seen around the reflection of strong light sources.

Haze is a common problem found in coating applications such as automotive, powder coatings and high gloss coatings.

Haze is often the result of poorly executed production process like poor dispersion or incompatible raw materials. For polished metal surfaces, haze is typically due to polishing marks or chemical residue.

Both Haze (HU) and Log Haze (HULOG) parameters are capable of quantifying reflection haze with the latter having higher resolution.

Orange Peel and Distinctness of Image (DOI)



Figure 3 – Example of surface marked with orange peel

The term [orange peel](#) describes a surface with rough texture that resembles the skin of an orange. Orange peel is undesirable in the [automotive industry](#) and high gloss coating applications.

Some factors that influence the levels of orange peel are:

- Substrate materials and alignment
- Application technique
- Coating formulation
- Orientation in which the coating is applied
- Application conditions like temperature

Traditionally, orange peel was evaluated visually using standardized panels with varying levels of orange peel. This method is time consuming and subject to individual judgment. It also lacks the necessary data to help identify underlying causes.

[DOI](#) was one of the first methods used to assess orange peel. DOI, as the name suggests, describe the sharpness of a reflected image on a surface. If the reflected image on a surface appears sharp and clear, the surface has high DOI. Conversely, if the reflected image is of low contrast, the surface has low DOI.

Today, as coating technology advances, a surface marked with orange peel can easily achieve high DOI as shown in Figure 4. The panel has a high DOI of of 96.2 even though orange peel is clearly noticeable on the panel.

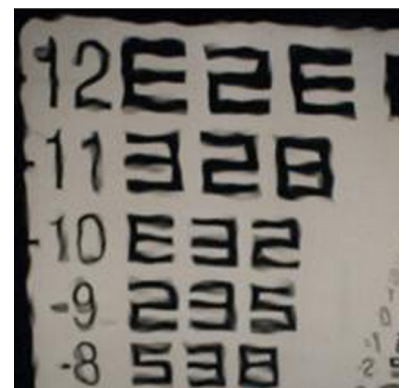


Figure 4 – Panel with high DOI but showing visible orange peel

Understanding Appearance Measurement

Reflected Image Quality (RIQ)

Like DOI, [RIQ](#) describe the sharpness of a reflected image on a surface, but with a greater sensitivity. This higher resolution parameter is achieved by reducing the sensing distance around the specular angle.

In Figure 5, you can see that as the amounts of orange peel lessen from Panel 1 to Panel 5, they are showing marginal difference in their DOI that is not in proportion to their visual difference.

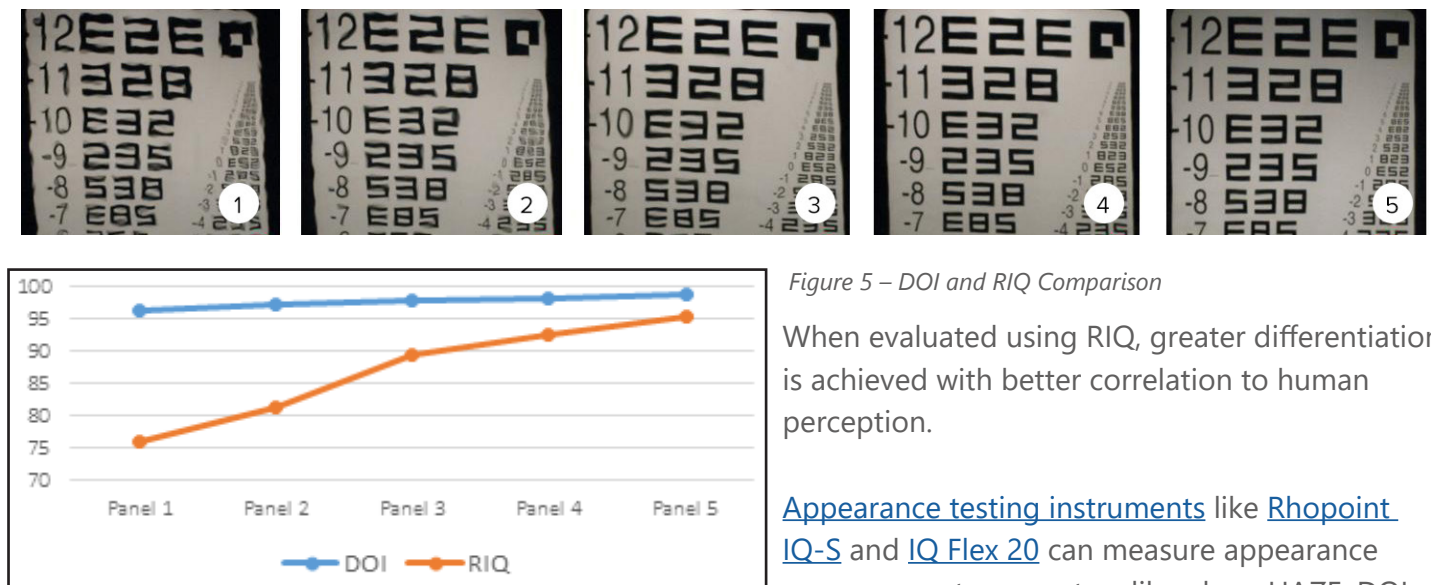


Figure 5 – DOI and RIQ Comparison

When evaluated using RIQ, greater differentiation is achieved with better correlation to human perception.

[Appearance testing instruments](#) like [Rhpoint IQ-S](#) and [IQ Flex 20](#) can measure appearance measurement parameters like gloss, HAZE, DOI

and RIQ simultaneously, providing a comprehensive and objective assessment of surface defects with ease.

[Get in touch](#) with us to learn more about appearance quality measurement or to schedule your free product demonstration.