

Color matching is a basic but critical component of product manufacturing across industries, and manufacturers go to great lengths to ensure color consistency throughout their production process. Sometimes, this is fairly straightforward, particularly if a product is being manufactured using a single material and pigmentation source. However, when the color of multiple, different product types must be visually identical or a [product is being assembled using a variety of materials undergoing unique manufacturing processes, color matching becomes more challenging](#). One of the primary obstructions to accurate color matching in these situations is illuminant metamerism, which must be identified through the sophisticated analytical capabilities of spectrophotometers.

## What Is Metamerism?

Illuminant metamerism describes the phenomenon in which two different colors appear to be identical within one lighting condition but not another and it presents special challenges for color matching.<sup>1</sup> For example, a sweater may appear to be a perfect match to a pair of pants under the fluorescent lights of the dressing room, but exposure to daylight reveals drastic chromatic differences. This is due to the fact that color perception is the product of how light interacts with an object, producing differences in how color information is interpreted based on illuminant source. Even slight color variations can create significant problems for manufacturers who require consistent pigmentation within or between products.

## The Necessity of Spectrophotometers

Because illuminant metamerism is the result of the relationship between a light source and an object, identification must be made using spectral reflectance instrumentation. Each object produces reflectance data that creates a particular spectral curve based on its chromatic properties. When two objects have identical spectral reflectance curves, they will be a visual match under all lighting conditions. However, when the objects have different curve shapes but intersect at at least three points, they are likely to be metameric. In order to identify and interpret these curves and assess the optical properties of the object, spectrophotometric instrumentation with advanced spectral analysis capabilities must be employed. By interfacing the spectrophotometer with computer software, you can produce precise graphic representations of each object's spectral reflectance qualities. Spectrophotometers, unlike tristimulus colorimeters, also have a wide range of spectral power distributions to mimic a variety of lighting conditions, allowing operators to observe their exact differences in object behavior under different illuminants.<sup>2</sup>

## The Metamerism Index

Not only do spectrophotometers offer the ability to identify metamerism, they also allow you to produce a Metamerism Index (MI), a single number that indicates how well two objects that are a color match under one lighting condition will match under a different condition. In order to calculate this index, a reference illuminant – typically CIE Illuminant D65 – is compared to another illuminant chosen based on the conditions under which it will be used or displayed. Textiles that will be presented to consumers under fluorescent store lighting, for example, [are typically evaluated using CIE Illuminant F2](#). HunterLab software can easily calculate the MI based on your chosen illuminants and give you precise, quantifiable information through highly reliable mathematical calculation using L, a, b values. If the MI is less than 0.5, you can be assured of a solid match while MIs between 0.5 and 1 are not reliable matches and anything above a 1 is a definite mismatch. The index is an invaluable tool for those seeking to create a visual match using two different color sources, providing a high level of quality assurance and allowing manufacturers to tailor their formulations for optimal color consistency.

Full article with photos available here:

<https://www.hunterlab.com/blog/color-measurement-2/challenges-in-color-matching-using-spectrophotometers-to-identify-illuminant-metamerism/>

