ECM Tech Brief

Why Daylight? …and, do you suffer from Metamerism?

GretagMacbeth viewing booths permit accurate color viewing under all phases of daylight.

Why Daylight?

Daylight renders color accurately. Since natural daylight changes throughout the day and with changes in the weather, the need exists to simulate daylight. Almost 100 years ago, Norman Macbeth – an illumination engineer and founder of the former Macbeth – identified the need to use simulated standardized daylight for making accurate visual color judgments.

Depending on the light source, color perception varies. That's because the spectral quality or color content of the light affects how we see color. The spectral quality of natural daylight depends upon atmospheric conditions, geographic location, time of year – even time of day. For example, the color appearance of early morning sunrise and late afternoon sunset can be as low as 2300° Kelvin (also known as horizon daylight*). At noon, the color appearance of light is approximately 5000° Kelvin and can exceed 10,000° Kelvin (on a clear day facing a north sky).

Daylight is evenly balanced across the visible spectrum – it has equal amounts of red, orange, yellow, green, blue, indigo and violet light energy. That means it more accurately renders color. Without this balance, colors aren't rendered precisely causing the light source to accentuate certain colors while suppressing others. Even slight deficiencies or excesses in light energy could skew your color perception causing you to approve or reject samples erroneously.

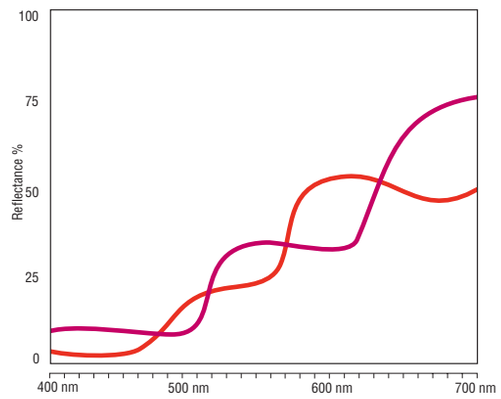
Norman Macbeth pioneered the development of accurately simulated daylight. This technology is still used today in GretagMacbeth viewing booths which permit accurate color viewing under all phases of daylight – including filtered tungsten halogen daylight, horizon daylight, blended daylight, and patented 7-phosphor fluorescent daylight. GretagMacbeth lighting products provide accurate simulation of daylight and can be used at night for second and third shift color evaluation.

**unique to GretagMacbeth SpectraLight*

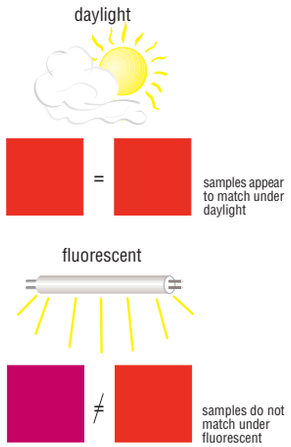
Do You Suffer From Metamerism?

Metamerism is the phenomenon of objects having their color match under one set of

Metamerism Evaluation



reflectance curves of a metameric pair



Metamerism is caused when the spectral reflectance or transmittance curves of each object differ.

conditions – real or calculated – and not match under different conditions. Two objects exhibiting metamerism are said to be a metameric pair.

What causes metamerism? It's caused when the spectral reflectance or transmittance curves of each object differ. When the reflectance curves of the two objects cross one another three times or more, metamerism takes place. *(See illustation.)* For example a mobile telephone consists of several component parts that may be comprised of different resins and colorants. When the parts are assembled into a phone, all the components should visually match under daylight and at least two other light sources giving the phone a uniform appearance. If, for example, the battery housing appears to be a different color than the main phone housing, metamerism could be a factor. Colorants used to create a product can differ from batch to batch, lot to lot or supplier to supplier. Colorants used in some applications may not work in others. The more colorants added to create a batch or correct a mistint, the greater the risk of metamerism.

How can you avoid metamerism? You can't completely avoid metamerism in most applications; however, you can minimize its effect through early detection. Remember to evaluate samples under daylight and at least two other light sources. Review spectral curves from a spectrophotometer (not a colorimeter) to detect and evaluate the degree of metamerism. Finally, samples that may have a directional characteristic such as textured plastic must be viewed from the same angle to avoid geometric metamerism.

Other Forms of Metamerism:
Observer metamerism is when samples that appear to match to one observer do not seem to match to another. Often the cause is differing color vision between the viewers – a fact that can be established with a color vision test.

Geometric metamerism is when object color matches at one angle of illumination but not when the angle is changed. This situation often occurs with materials that are directional – velvet, suede, broadlooms, plastics, and metals.