Applications Note

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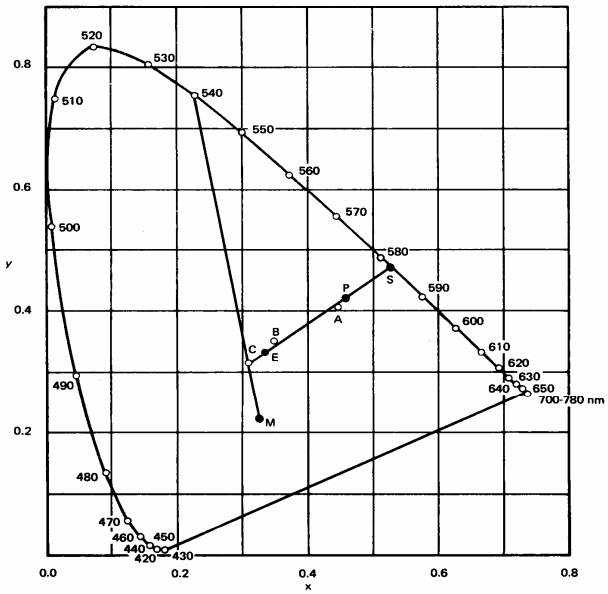
Yxy CIE Chromaticity Coordinates

Background

The XYZ CIE Tristimulus Values do not correspond very well to the visual attributes of a color. The Y value is the only one that is easy to understand because it correlates with lightness. In an attempt to develop a more understandable color scale, the CIE developed the CIE Chromaticity Coordinates x, y, and z, which are calculated from the CIE Tristimulus Values (XYZ). Most often, the values of Yxy are reported as CIE Chromaticity Coordinates. This is because Y provides a lightness function. The sum of x, y, and z is 1.0, so z can be determined easily if needed.

Here again, the xyz values do not correspond very well to the visual attributes of a color. By plotting x and y on a Chromaticity Diagram, the color may be specified. Below is an example of a Chromaticity Diagram.



On the Chromaticity Diagram, x is the horizontal axis and y is the vertical axis. There would be a slightly different diagram for each value of Y. You can imagine the Y axis perpendicular to the page on the Chromaticity Diagram above. Wavelengths form a horseshoe shape that is referred to as the

spectrum locus. The bottom of the spectrum locus is closed with a straight line that connects the first and last wavelengths.

Dominant wavelength and excitation purity may be determined using Y, x, and y. The dominant wavelength is the wavelength of light that would match the color if it were a pure color. It is a way of expressing hue. Excitation purity is an indication of saturation. It tells how close a color is to being the pure spectral color located at the dominant wavelength.

Conditions for Measurement

Instrumental: Most HunterLab color measurement instruments provide Yxy data. Not all instruments provide dominant wavelength and excitation purity.

Illuminant: Any

Standard Observer Function: 2 or 10 degree

Transmittance and/or Reflectance: Either.

Formulas

$$x = \frac{X}{X + Y + Z}$$

$$y = \frac{Y}{X + Y + Z}$$

$$z = \frac{Z}{X + Y + Z}$$

Dominant wavelength = S

$$\text{Excitation purity} = \frac{CP}{CS}$$

where

C = Illuminant location for CIE illuminant C

P = Sample location

S = Wavelength where the line through C and P intersects the spectrum locus

CP = The distance between the illuminant and the sample

CS = The distance between the illuminant and the spectrum locus.

Refer to the Chromaticity Diagram above.

Typical Applications

This color scale may be used for measurement of the color of any object whose color can be measured. It is no longer used very often. Some glass/plastic filter and colored glass manufacturers use this scale.

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