PaperWise™

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Board Sales

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March 2001

White, Bright, Blue

Understanding Appearance Terminology

Linerboard appearance can affect how consumers perceive your packaging. There are a number of terms papermakers use to characterize the appearance of white top, bleached and coated linerboards. Most of these terms describe one of two things, the product's color or the evenness of the paper's color. Knowledge of the terminology used to describe appearance qualities allows you to communicate your needs effectively with your paper supplier. In this edition of Paperwise, we will explain some of these important terms.

But first, let's review a few factors that can affect how white liners are perceived by the human eye.

Illuminant type. White light contains all colors of the color spectrum. There are various types of lighting (called *illuminant*) distinguished by their colors (called *spectral makeup*). In the containerboard industry there are two illuminant types used, "C" and "D_{65}". Both the C and "D_{65}" illuminants simulate daylight. However, the "D_{65}" illuminant has a larger fluorescent content than "C" illuminant. These illuminants are most often used since they most closely approximate the lighting conditions where paper and packaging are viewed. Since white liners reflect the lighting source, the color of the illuminant can play a pivotal role in how we judge packaging.

Paper grain. Just as wood has a grain, paper also has a grain. When light is reflected from a paper's surface it is scattered differently by the paper's grain. Paper reflects less light when it is illuminated from the cross-grain direction due to more scattering. But people do not notice this effect because our viewing environment (such as work places or stores) lights the paper from all directions (called *diffuse illumination*). Diffusely illuminated samples are not affected by paper grain. Lighting the paper from one specific direction (called *directional*), as with a flashlight for instance, can reveal the effect of paper grain on brightness. Though the difference is small, it is important to know when making brightness measurements because there are devices which illuminate paper directionally or diffusely.

Evenness of Color

Appearance Mottle. This term is generally specific to white top or coated white top linerboard. On unprinted liner this term refers to an uneven, marbled or blotchy distribution of bleached fiber. The eye sees the mottle in the box below as unevenness in the white color. As little as five years ago, the North American market was filled with a number of "mottled white" linerboards. But the standard has changed. Today, with the exception of a dirty sheet, a mottled appearance is the single most objectionable appearance quality a liner can have. Imagine an image being printed on the sheet in the box above versus a uniformly white surface.

Because mottle tarnishes appearance, linerboards that have low levels of mottle are perceived as being "whiter or brighter" than linerboards that have a higher degree of mottle — even at the same brightness. Papermakers monitor the degree of mottle using methods ranging from to simple visual rating against appearance standards.

Linerboard Color

Since people view colors differently and there are numerous color shades, we cannot rely solely on the human eye to consistently and accurately judge color. There are primarily two color systems that express color in three-dimensional coordinates. These coordinate systems are more complex than can be described here, but the three dimensions relate to light-dark (*L-value*), red-green (*a-value*) and blue-yellow (*b-value*) content of a particular color. These color coordinates express the various shades and intensities of color and are the standard method for communicating color measurements. There are two slightly different systems,

called Hunter and CIELab, that use these values. Therefore, it is important to specify the system used when communicating in color coordinates. Papermakers will use these coordinates as their measurement system for controlling the color of linerboard. A first-rate color device can measure all the color qualities discussed in this section.

Brightness is the most popular term used to characterize the color of white top, bleached, and coated linerboard. Brightness is the percentage of blue light reflected back from the paper's surface relative to a standard. But, white light contains all colors so why look at only the blue portion?

Brightness readings are taken at a specific wavelength in the blue portion of the white light spectrum because the measured reflectance of bleached fiber is the most sensitive to changes in this region. A higher reflectance number denotes a brighter sheet. Consequently, papermakers can control brightness more accurately because of this phenomenon. Brightness is measured on a color device equipped to filter all light except light at a 457nm wavelength (blue light).

Blueness refers to the shade of the bleached fiber – whether it is a bluish white or a yellowish white. For instance, photocopier papers typically have a very bluish white shade (called a cool white) compared to white liners which tend to have a yellowish white shade (called a warm white). But blueness is a relative term. Most liners are on the yellow side of the color scale; however, when comparing liners of varying yellowness, the liner with the least yellow color looks "bluer". Most papermakers work to control the blueness to make the product appear whiter and more attractive. We will explain why papermakers strive to control shade in the blue direction under the discussion on whiteness. Blueness is also measured with a color device and is usually reported as the b-value. Negative b-values signify a blue shade while positive values indicate a yellow shade. Remember, with white liners, blueness is a relative term.

Whiteness is often used interchangeably with the color term *lightness* or *L-value* and brightness. However, as we've already discussed, brightness only considers the reflection of a very specific blue light. Whiteness looks at the full visible spectrum of reflected light and weights human preference to determine a single value. A whiteness number is computed using the color coordinates measured by a color device. The higher the whiteness number, the whiter the sheet will look. Generally speaking, people prefer whites to have neutral redness (a-value), meaning no green or pink tint. Bluish whites look brighter to the human eye while yellowish whites may look dingy or dirty. Because humans perceive bluish whites to be brighter, papermakers will control the shade toward a bluer shade for visual appeal. An ideal white substrate will have an almost neutral blue shade and neutral redness.

The Total Package

How does appearance affect the consumer's view of packaging? From a graphics perspective, print contrast is key. Attractive graphics require a bright white canvass to yield maximum contrast between the paper and the inks. Bluish whites give a bright white perception to the human eye. However, if the substrate is mottled, the graphics will lose contrast and the colors will look dirty.

For packaging with a small amount of print or graphics, color and uniformity are still important. A yellow mottled container can give consumers the impression that the goods in the container are old or that the product has been sitting on the shelf for some time. This could lead them to select a competitive product packaged in a brighter, less mottled substrate. How is your white liner impacting the appearance of your packaging?

If you would like more information on linerboard appearance or other technical topics, contact your Smurfit-Stone Sales Manager or call us toll free at 1-877-785-7835 or by e-mail at paperwise@smurfit.com