Applications Note

Insight on Color **Vol. 15, No. 10**

Sample Thickness and Reflectance Color Measurements

Flexible, translucent samples like fabrics and paper reflect enough light that their reflected color may be measured, but they also transmit light. In the picture below, you can see the reflected color of the fabric (the color reflected back to you from the surface of the fabric), and you can also see the instrument that is behind the fabric.

When you're looking at the reflected color of a translucent sample, the light that is transmitted through the sample is lost to the reflectance assessment. One way to prevent this loss of light is to provide a backing for the sample to make it appear more opaque. With flexible samples, you can back the sample with more of the same sample by folding it into layers. The picture below shows the same fabric folded into eight layers.

Does the sample folded into layers look the same as the single layer? No! This folded sample appears opaque and more saturated as far as the buttery yellow color. The samples look different to your eye with a different number of layers. Is the same thing true when you measure with an instrument? You bet.

The sample above was measured on an UltraScan XE in RSIN mode, first with no folding (1 layer), then with one fold (2 layers), two folds (4 layers), and three folds (8 layers). Measurement of one layer and eight layers are illustrated below.

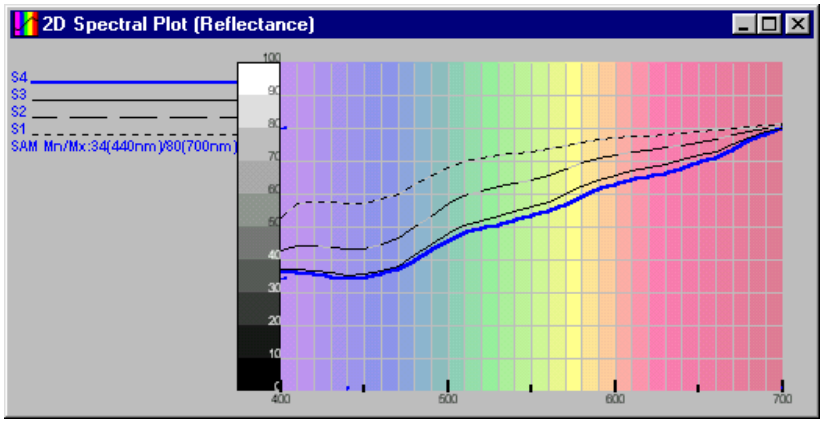
Measurement of one layer

Measurement of eight layers

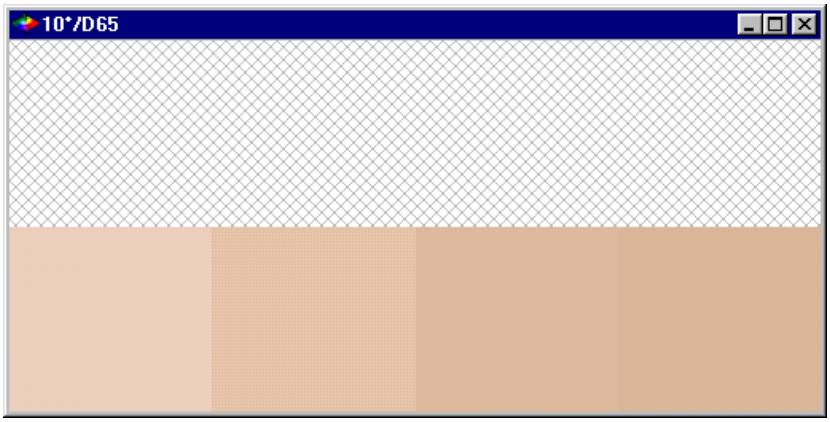
The following color values were received (D65/10°).

Layers	L*	a*	b*
1	88.23	0.21	11.94
2	84.10	2.16	18.70
4	79.89	4.58	21.20
8	78.38	5.04	20.12

Just as we had noted visually, the color saturation increases (larger a* and b*) and the lightness decreases (smaller L*) as the number of layers presented to the instrument increases. The spectral plot and color rendering view shown below also illustrate the differences detected instrumentally.



The spectral reflectance plot for the sample. The top curve is the one-layer sample and the bottom curve is the eight-layer sample. The curves are approximately the same shape.



The color rendering (approximation of what the instrument sees) for the sample. The left box on the bottom is the one-layer sample and the right box on the bottom is the eight-layer sample.

So, what does all this mean? It means that for each type of flexible, translucent sample you measure and compare, you need to choose a number of layers, record that number of layers as part of your measurement, and stick with it. If you measure some samples in two layers and other samples in eight layers, you will not be able to compare the measurements. So, what is the proper number of layers for your samples? That depends.

Thick, near-opaque samples like denim and cardboard may be able to be measured sufficiently in only one layer. Medium-weight samples like cotton knit may require only two or four layers to reach opacity. Sheer samples like the one used in this example will require eight or more layers to reach opacity. You can experiment by measuring the same sample in different numbers of layers until you find that the measurements no longer change with additional folds.

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