Frequently Asked Questions

Fading and Discoloration in Relation to Lighting

How can controlling lighting limit the fading and discoloration of materials?

Fading and discoloration of materials can be caused by a variety of environmental factors including adverse temperature and humidity conditions, atmospheric pollutants, and various forms of radiation including ultraviolet (UV), visible (light), and infrared energy. UV and light can cause fading through photochemical processes. If light is a cause of fading, it will be by that component that is absorbed. The reflected component that relates to the color appearance of an object will not induce photochemistry. Even if there is no direct photochemical action due to absorbed light, absorbed light as well as infrared can heat the materials. Such heating can accelerate fading and degradation caused by other factors.

It is difficult to generalize on the effect of UV and light since fading depends on the specific colorants involved. However, fading is proportional to the product of incident power with exposure time. For a given type of lighting, this would be the product of footcandle level (illuminance) with exposure time. Consequently, fading can be reduced by decreasing either the light level or the duration of exposure. For a given degree of fading, one can trade light level with exposure time.

The UV emission per lumen for most fluorescent lamps falls within a limited range, and this range has been consistent for decades. Thus, for a given footcandle level, the UV should be similar for all fluorescent lighting except where certain luminaires or particular lighting techniques greatly attenuate or eliminate the UV component. This statement applies whether the lamps are of the T8 or T12 types.

There is no obvious reason that fading should increase under T8 lamps compared to under T12 lamps. If UV attenuation due to luminaires was greater in an old T12 system than in the new T8 system, this might account for some increased fading. A difference of this type is a luminaire and lighting system design issue, not a lamp issue. For example, completely enclosed fluorescent luminaires, such as with lens/diffuser panels or "wrap-around" diffusers, will essentially eliminate the small traces of shorter wavelength UV emitted from lamps. Open louvers will permit some fraction of this trace UV to escape.

Clearly note that when a change is made from older lamps such as the Cool or Warm White types common in T12 lamps to T8 triphosphor lamps, color rendition will improve. Often this improvement also can make it easier to see small color differences such as those due to fading.

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When color is important to quality and value such as with some work of art, fading due to the lighting is limited by three techniques. (1) The light level is kept as low as possible commensurate with good color vision and viewing conditions; (2) unnecessary radiant power such as the UV wavelengths are filtered from the light; and (3) the duration of display is limited.

In merchandising situations, fading can be controlled by not putting goods on high shelves near luminaires. Also, rotating the stock will let the lighting affect all merchandise equally. Color differences between adjacent goods are particularly noticeable; this is much more important that any slight change in absolute color. Reducing the time that the light levels are high also reduces any possible fading. For example, lower the light level during cleaning and maintenance when the store is closed. In especially critical situations, UV blocking filters can be incorporated in luminaires, as sleeves over fluorescent lamps, as coatings on display cases, etc.

Finally note that good color rendition lighting, high light levels, side-by-side comparisons of samples, etc. are some of the factors than can make obvious small color differences that would not be seen under less advantageous conditions.

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10/97