

Setting the Mood in Solid State Lighting

With the emergence of new lighting applications and a plethora of novel capabilities that LED-based solid-state lighting systems promise to bring us, engineers and lighting designers will have the ability to transform the way we see the world. One feature that these specialized SSL systems are readily capable of is the ability to tune the chromaticity of light emitted from a luminaire. Don't like the color of the light in the room? No problem: simply turn a knob, point to a color on your smartphone touch screen, or take a few clicks on your mouse, and you will have all of the colors of the rainbow (or the CIE 1931 color space, for all you nitpickers) at your fingertips. Systems can also be configured for more conventional functionality and emit white light of varying color temperatures. By populating luminaires with cool and warm color temperature LED strings and varying the current level in each string, one can mix the color of the "cool" (down to 2700K) and "warm" (up to 7500K) LEDs with a diffuser to emit a white light of varying color temperature. Similarly, a wide variety of colors, not limited to the Planckian locus, can be created via manipulation of red, blue, and green LEDs within a luminaire. This manipulation of color temperature and/or chromaticity can be accomplished via pulse width or linear modulation of the separate (warm and cool, or red, blue, and green) LED string currents. In most cases, pulse width modulation, or PWM, will allow for a more consistent color from each LED string throughout the dimming range. It will also allow for a wider color control range, as the LEDs can be dimmed by a PWM easily to .01% of their nominal light output. Linear modulation of LED string current will work as well, and there is no possibility of visual artifacts, as there is with PWM, but the LEDs will not maintain a color consistency over the entire range. Driver circuitry will also be limited in its ability to dim less than 5 or 10% of nominal current, which will have an impact on the range of control. Driver cost and complexity will be higher for these higher functionality drivers than for single string, or monochrome luminaires, but those willing to pay for the features will have a nearly unlimited set of options when it comes to setting the mood.

Potential high level topics:

Cool color for task lighting – ability to see objects more clearly

Warm color for mood lighting

Color for street lights to reduce light pollution

Color for photosensitive materials.