White Paper: Ensuring Success When Switching from Conventional Lamp to LED Light Curing Sources

The Dymax white paper ***Ensuring Success When Switching from Conventional Lamp to LED Light Curing Sources*** discusses topics such as how LED curing works, the advantages of LED curing, and getting enough information to switch successfully. LEDs, or light emitting diodes, continue to gain popularity as a replacement for traditional light bulbs, not only in homes and public buildings, but also for use with light-curable materials (LCMs). Because of the differences in the technology, making the switch from broad spectrum to LED-curing energy sources is seldom a matter of simply replacing conventional lamps with LED units.

Switching to an LED system depends on careful consideration of all the factors involved, from the material to the curing unit selected for the application. With attention to detail and proper compatibility of all components, along with sufficient adjustments to manufacturing processes, it is possible to achieve a successful transition to LED light-cure technology.

Download a copy from our Technical Articles & White Papers webpage. And find out more about LED lamps and LED curing materials.

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DYMAX

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LEDs, or light emitting diodes, continue to gain popularity as a replacement for traditional light bulbs, not only in homes and public buildings, but also for use with light-curable materials (LCMs). The rise of LEDs is attributed to the notable benefits attached to them, and some advantages are associated specifically with light curing.

Because of the differences in the technology, however, making the switch from broad spectrum to LED curing energy sources is seldom a matter of simply replacing conventional lamps with LED units and leaving all else the same. To ensure success in curing LCMs with LED light sources, the chemistry of the material must be compatible with the specific LED system chosen, and any necessary application-specific adjustments must be made. What makes LEDs different? Is it really worth switching? What must be addressed during the migration process? Is the change possible? These questions are answered here.

How LED Curing Works

To understand the benefits and limitations of LED curing, it helps to understand what actually happens during the curing process. When the LED light source emits energy of the correct spectral output for the LCM, the photoinitiator in the LCM fragments to form free radicals and the curing process begins. The free radicals begin to form polymer chains with the acrylates that comprise the LCM until all of the available radicals have attached and become a solid polymer. At that point, the end of the curing process, called termination, has occurred and the LCM has polymerized, or cured.

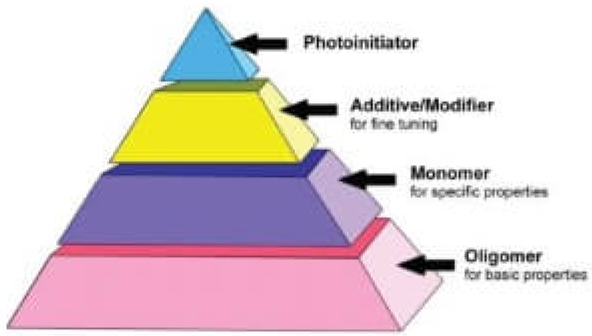
Most of this is the same as curing with broad-spectrum bulbs, with one critical difference. LEDs emit energy in a narrower portion of the spectrum than broad-spectrum lamps, which means the LCM must be designed to cure within the wavelengths emitted by the particular LED unit. This difference can affect the cure of many light-curable materials, especially when those materials were originally optimized to cure under broad-spectrum light.

Advantages to LED Curing

There are several advantages to be gained in switching from a broad-spectrum to an LED curing source. For instance, LED systems operate at lower temperatures than conventional broad-spectrum lamps. Because some substrates are sensitive to higher temperatures, curing an LCM fully without damaging the substrate can require multiple passes under a broad-spectrum lamp at lower intensity levels. These multiple passes may be necessary to avoid thermal rise of the substrate or part that can be caused by a single pass of a longer duration. Those extra steps can be made unnecessary by switching to the cooler LED units.

Another benefit of LED curing sources is that they last longer. Although LEDs also degrade in intensity output over time, a typical broad-spectrum spot-cure lamp might last about 2,000 hours before intensity output levels degrade to about 50% of initial levels. Conversely, if properly designed, LED curing units can often provide over 50% of their original intensity output at up to 20,000 hours. Additionally, since LED units turn on instantly with no warm-up, there is no need to leave them on when they are not in use, which further increases their longevity. In all cases, a radiometer is essential for measuring intensity and ensuring a successful light curing process.

Furthermore, LEDs provide a more uniform distribution of light across the cure area for more consistent results. They are also much more electrically efficient and more environmentally friendly than mercury-arc curing lamps, thus eliminating safety hazards and cutting costs.



Typical components of a light-curable material.

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