High Brightness LED
Assembly Trends, Materials and Issues

Many issues must be overcome before high brightness LEDs (HB LEDs) are widely accepted as replacements for either incandescent- or CFL-based luminaires. Reducing cost and improving reliability are key issues in expanding the use of HB LEDs, and packaging and assembly of these devices is increasingly recognized as an enabling factor. There are no standard packages for LEDs and many different types of packaging are used. In order to lower the packaging cost of HB LEDs (estimated to be as much as 50 percent of the total cost) standardization and the use of the existing assembly infrastructure will be necessary.

Thermal management and package design are increasingly important in HB LEDs. Controlling the LED junction temperature is critical to LED performance and can impact the lifetime of the LED. Adequate thermal dissipation is important in preventing degradation both of the phosphors in the LED package as well as the packaging materials themselves. Various methods are being used to improve thermal performance of HB LEDs including new substrates and sub-mounts, increased use of flip chip assembly, and improved thermal interface materials.

Packaging materials will also significantly impact the optical efficiency of an LED package. Changes in reflectivity, transmissivity, and index of refraction can impact the number of lumens out of the package and reduce efficiency. The stability of packaging materials (encapsulants and lenses) with exposure to elevated temperatures and UV and other wavelength radiation is critical to insuring long-term reliability and maintenance of performance over the lifetime of the luminaire.

The report reviews HB LED assembly trends and issues; materials used today, and requirements for the future. Examples of various packages for high brightness LEDs are used to illustrate the diversity in package options. Critical issues, including thermal and optical, are addressed. Material requirements and unmet needs are described.

1. High Brightness LED Applications and Markets (backlights for LCD monitors and TVs, mobile devices, signs, signals, automotive, and illumination)
2. Assembly Examples and Issues (wire bond, flip chip, pick and place, wafer singulation, etc.)
3. Material Trends and Challenges (leadframes, ceramic substrates, sub-mounts, heat sink materials, encapsulants and underfills, thermal interface materials, lens, etc.)
4. Material and Equipment Suppliers

Availability: Fall 2010

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