Advances in Solid-state Lighting Promise Higher Energy Efficiency and Greater Design Flexibility

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Considering the growing importance of energy savings and environment friendliness, solid-state lighting is emerging a highly competent and viable alternative to existing lighting technologies. While light emitting diodes (LEDs) promise numerous advantages such as higher energy efficiency, longer life and reliability, as well as low temperature performance, customer requirements for innovative solutions that provide better control over the color, shape, and intensity of light is driving the demand for organic light emitting diodes (OLEDs) as light sources.

The energy savings provided by the use of LEDs has attracted lot of government-aided funding and initiated a race between countries to establish solid-state lighting. Europe, America, Japan, China, and South Korea have government initiatives such as the Next-generation Lighting Initiative (NGLI) and 'Light for the 21st Century', sparking innovations and speeding up R&D in the field of solid-state lighting.

"However, despite LEDs having surpassed the efficiency of incandescent lamps, their biggest challenge lies in outperforming the efficiency of fluorescent lamps, which at present is greater than ninety lumens per watt," notes Technical Insights Research Analyst Ashwini Meena. "Further, LEDs have to improve their color uniformity and surface brightness as well as increasing their efficiency while maintaining the quality of the white light produced."

In respect to OLEDs, industry participants need to overcome key challenges such as outcoupling and sensitivity issues in order to increase the light output. Since increasing light output is dependent on the device technology and the chemistry of materials involved, the challenge lies in making the lifetime of the generated photon's last nano or microseconds.

Nevertheless, research institutions across the globe are working towards addressing these shortcomings and the US-based PhosphorTech Corporation is developing low-cost high-extraction luminescent structures (HELMs) to increase the light extraction efficiency of standard LED devices. These HELMs perform dual roles as they convert the light from blue/ultraviolet (UV) LEDs to white and increase the extraction efficiency of blue/UV light from LEDs through refractive index matching.

The differential feature of this approach is seen not only in its low cost and compatibility with standard LED packaging processes, but also in the fact that it provides unique phosphor materials with greater color flexibility than the current standard used by LED manufacturers.

Over in Europe, the race is on to establish the use of OLEDs for general illumination and the region is aiming to be the frontrunner in this field with its collaborative organic LEDs for ICT and lighting applications (OLLA) project. OLLA has 24 consortium partners from eight European countries, including ten industrial partners as well as seven universities and research institutes and its main aim is to develop a white light OLED tile of 15-by-15 centimeters by 2008. Additional targets set include high brightness (1000Cd/m2) and increased efficiency (50 lumens per watt) along with an extended lifespan (10,000 hours).

"Considering their numerous benefits and superior performance levels, solid-state lighting technology promises innovations in the application areas of decorative, signage and signaling, entertainment, display, as well

as automotive lighting," says Meena. "Nevertheless, in ensuring its wider reach, solid-state lighting has to ensure its cost competitiveness in comparison to existing lighting technologies."

Source: Frost & Sullivan