



by James Brodrick

While they've yet to gain widespread traction, OLEDs are making inroads in the marketplace as a complement to LEDs

With so much attention being paid to LEDs, many people don't realize that solid-state lighting includes another technology. OLEDs (organic LEDs) are several years behind their inorganic cousins in terms of development for general illumination, but they have similar energy-saving potential and also bring a number of unique advantages. For instance, unlike LEDs, OLEDs are diffuse light sources, and they can be made on flexible substrates, which opens up a whole new dimension of form-factor possibilities.

While OLED lighting has kept a pretty low profile up until now, that's starting to change as the technology continues to make progress on many fronts. For example, many performance issues have been overcome, and as a result, OLED panels have been improving. The use of tandem stacks has made for good brightness at low current densities, with today's OLED products typically producing 3,000 cd per sq meter. Efficiencies of 60 lumens per watt have been around for the past few years, but higher performance appears to be just around the corner. Lifetimes have improved dramatically as well, and good color has been achieved, with most OLED lighting products now having a CRI >80 and some >90.

The cost of OLED lighting, which has been the biggest hurdle to date, has also been coming down dramatically—with a 40 percent drop over the past year alone. However, there's still quite a long ways to go in that regard. Early in 2014, the average price per klm was about \$500 for an OLED panel and \$1,400 for an OLED luminaire. Compare that with \$16 for an LED lamp,

\$43 for a 6-in. LED downlight, \$4 for a fluorescent lamp and ballast, and \$2.50 for a halogen lamp. LG Chem's recently announced plans to sell OLED panels for \$200 per klm are a huge step in the right direction. Looking ahead, OLED panels are expected to drop to \$10 per klm by 2025.

FIRST STIRRINGS OF A MARKET

With the OLED lighting market starting to build momentum, we're beginning to see viable products in the marketplace—not just high-priced chandeliers, but functional products as well, such as a wall sconce and a healthcare-facility marker light, both by Acuity Brands. We're also seeing luminaire manufacturers experimenting with OLED prototypes having value-added features such as transparency, flexibility and color-tunability.

Rather than trying to force-fit OLEDs into lighting applications where they're up against formidable odds, manufacturers are finding the right applications for the technology, applications that are well-suited to its advantages. And more such applications are on the horizon. For example, Audi, Philips, Merck and Germany's University of Cologne have joined forces to produce a prototype car featuring 3D OLED rear lighting panels; BMW has developed a concept car that has OLED taillights; and UDC and IDD Aerospace are developing OLED lighting for aircraft interiors.

OLED lighting is also getting some recognition. Among the winners recently announced by the Next Generation Luminaires (NGL) Indoor Solid-State Lighting Design Competition was a family of OLED luminaires by Acuity Brands - Winona Lighting that received recognition in the



Acuity Brands' Nomi family of OLED wall sconces was recognized in the Emerging Products category of the 2014 Next Generation Luminaires design competition.

Emerging Products category, the first OLED products to be recognized by the NGL.

Meanwhile, DOE continues to provide support to the OLED lighting industry. One way we do that is by funding OLED R&D—with the latest recipients including Pixelligent Technologies LLC, OLEDWorks, Princeton University and UCLA. Another way is by helping to bring the various players together and build a collaborative framework to advance the technology. In October of this year, DOE facilitated a meeting of OLED lighting stakeholders in Rochester, NY, to provide an open forum for discussion with special emphasis on exploring basic science and applied research needs for OLED advancement, discussing product development and manufacturing challenges, and sharing updates on the efforts of a new OLED Coalition.

That coalition—an industry group that's carrying out marketing education efforts,

developing a manufacturing cost model and working on a business plan to support large-volume manufacturing, among other activities—was the result of discussions at a DOE-facilitated OLED meeting held in October 2013. The 2013 meeting also gave rise earlier this year to a new testing opportunity (www.ssl.energy.gov/oled-testing-opportunity.html) that enables component makers to incorporate various R&D-stage components into larger OLED components or panels. The results of this testing will lead to the identification of high-performing components with the ability to advance OLED technology performance and efficiency while reducing cost. One testing laboratory has already been qualified.

A VIABLE COMPANION

Why is DOE promoting the development of OLED lighting? Because we believe it

can be a viable complement to LED lighting in saving energy. For example, DOE analysis shows that using OLEDs instead of traditional designs in commercial corridors could bring energy savings of 73 percent, which translates into 163 tBtu per year, saving businesses \$1.7 billion in 2020.

OLED lighting has a long way to go before the technology reaches that point, but not as long a way as some might imagine. The industry is taking steps to heed the lessons learned from the market introduction of CFLs. Back then, early products were simply not ready for prime time because of quality issues and high prices, and consumers were confused and ultimately put off by exaggerated claims.

The key, then and now, is to find niche markets where benefits are tangible, admit and correct technical failures and limitations, back up lifetime claims with guarantees, and bring prices down. OLED lighting also has the advantage of being able to profit from the lessons learned from LED lighting's early days—such as taking into consideration the existing lighting infrastructure, negotiating the testing juggernaut and grouping products into families.

The bottom line is that OLED lighting is improving fast and, if it fulfills its potential, will bring a somewhat different—and quite intriguing—value proposition to the table. The opportunity is there, and the time is now.

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