

Cutting-Edge Reflector Coating Boosts LED Fixture Efficiency While Reducing Costs

Thanks to research partially funded by DOE, an innovative reflector coating boosts the efficiency of LED fixtures by directing the light where it's needed and reducing the amount that gets wasted. Higher efficiency means fewer LEDs need to be used, which reduces cost.

Light management is critical to any luminaire. No matter how efficient the light source may be, if the optics don't keep pace it can rival the proverbial cow that yields prodigious quantities of milk but keeps kicking the pail over. WhiteOptics addresses this problem by manufacturing low-cost, high-reflectance white coatings and applying them to film and metal for use in luminaires, to improve efficiency and light distribution. The company's customers are luminaire manufacturers—primarily those that make indoor fixtures.

WhiteOptics is headquartered in New Castle, Delaware, where it does its R&D as well as its core manufacturing (i.e., its plastics formulation). Some of the



LED luminaire parts coated with WhiteOptics' high-reflectance composite.
Photo credit: WhiteOptics.

coating process is outsourced to an East Coast facility, and the metal processing is done in the U.S. as well. The company got its start in 2009 and commercialized its first product in 2010. That same year, it received a DOE research grant that helped put the company over the hump by enabling it to develop and perfect its new coating technology.

Public-Private Partnership Speeds Innovative Product to Market

During the three-year DOE-funded R&D project, which ended in early 2013, WhiteOptics increased the overall reflectance of the composite coating, scaled up low-cost production methods, and

completed long-term accelerated durability testing. The result was a highly successful commercial product that can be applied to many different types of substrate and is now used in hundreds of luminaires by many designers and manufacturers. WhiteOptics' coatings are typically used in new, cutting-edge luminaires—which nowadays are primarily SSL. Whereas back in 2010, 90% of the company's sales were for use in fluorescent products and 10% for use in solid-state lighting, SSL now accounts

MARKET IMPACTS of WhiteOptics' high-reflectance coating

- LED light fixtures that include WhiteOptics' coating-based technology were estimated to have saved more than 30 megawatts of electricity in 2013, with those savings expected to grow by more than 50% in 2014.
- Four of the five largest U.S. lighting manufacturers offer LED luminaires that incorporate WhiteOptics' coating-based technology.
- WhiteOptics' foreign exports increased by 100% in 2013.

“DOE funding played a key role. At the time, we were a startup, and the funding reduced our risk and accelerated our R&D efforts by several years. Without it, we would have missed the window of opportunity. Sometimes a nudge from the public sector is needed to get the ball in motion, before the private sector takes over. DOE saw the potential, got things kick-started, and then handed the ball back to us.”

— Eric Teather, president of WhiteOptics

Some ultra-efficient LED fixture designs that make use of WhiteOptics' reflective coatings.
 Photo credit: WhiteOptics.



for more than 85% of sales—not because its fluorescent customers are dwindling, but because the number of SSL customers is rapidly increasing.

By maximizing light reflection, WhiteOptics' coating can increase luminaire output by 10%–30% over standard reflector materials. Based on a novel high-reflectance particle technology, the highly diffuse coating is applicable to backlit, indirect, and cavity-mixing luminaire designs and offers an overall system cost-improving solution for LED optics by allowing for uniform distribution of light without exaggerating the point-source nature of the LEDs. The coatings are especially well-suited to LED lighting because they're not only highly reflective but also highly diffuse, so they scatter the light efficiently, softening it and reducing “hot-spot” imaging and glare.

Leveraging the Learning

Because of the coating's high (97%) reflectance, which improves overall optical efficiency by 15%, the same light output can be achieved with 15% fewer LEDs. This increases energy efficiency, reduces cost, and extends luminaire lifetime by reducing system temperatures. The color

quality of the light is not affected by the coating, which is designed to withstand 50,000 hours or more of luminaire operation under expected LED system thermal and environmental operating extremes.

This is yet another example of how DOE funding resulted in a product that solves a need for the industry, and that advances solid-state lighting by bringing the cost down. WhiteOptics has already created another suite of products that leverages what was learned from the original project, and that the company is funding on its own. ■



WhiteOptics spray-coating its composite on high-reflective LED luminaire parts.
 Photo credit: WhiteOptics.

DOE SSL R&D INVESTMENTS

GOALS

1. Maximize the energy efficiency of SSL products in the marketplace.
2. Remove market barriers through improvements to lifetime, color quality, and lighting system performance.
3. Reduce costs of SSL sources and luminaires.
4. Improve product consistency while maintaining high-quality products.
5. Encourage the growth, leadership, and sustainability of domestic U.S. manufacturing within the SSL industry.

WHY IT MATTERS

- Technology innovation fuels U.S. economic growth and job creation.
- LEDs that are more cost-competitive will accelerate markets for energy-efficient solid-state lighting, saving energy for American homeowners and businesses while reducing carbon emissions.