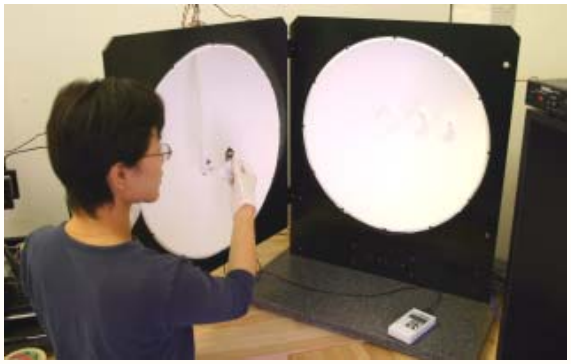
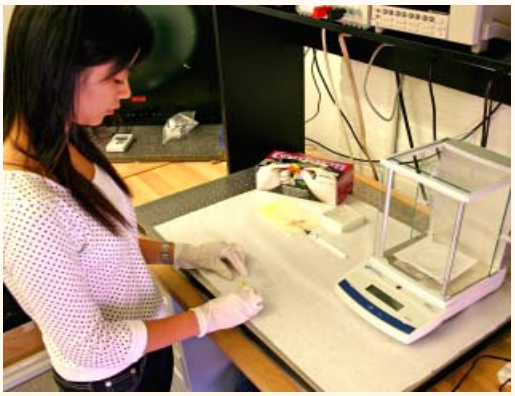
High-Efficiency Solid-State Lighting

What if a white LED could last 10 years or longer? Such an LED would have an efficiency 10 to 15 times greater than that of an incandescent lamp, making it the most efficient, non-toxic visible light source available. According to the U.S. Department of Energy, consumers using high-efficiency LEDs could save $30 billion annually in electricity costs and significantly reduce carbon emissions produced by power plants.

Researchers at the LRC and U.C. Santa Barbara are working to develop solid-state lighting into highly efficient general illumination systems for homes and offices.



A white LED is placed inside an integrating sphere for light output and spectrum measurements.



An LRC researcher mixes epoxy and phosphor for testing.

Further study

In addition to new packaging designs, LRC researchers are exploring desirable package configurations for the new white light source. This work will ensure wide acceptance by people once the high-efficiency target is met.

For more information, visit:
www.lrc.rpi.edu/programs/solidstate

Project details

The LRC and UCSB are complementing each others' research activities in this three-year project. Professor Shuji Nakamura, inventor of the gallium-nitride LED, and his team at UCSB are investigating the creation of highly efficient, nitride-based, short-wavelength emitters. Recently, UCSB demonstrated an improved light emitter using a resonant-cavity structure. Dr. N. Narendran and his team at the LRC are focusing on the challenges of packaging this new emitter to create a highly efficient white light source. Unlike the traditional method of incorporating phosphor with the semiconductor to produce white light, the LRC recently demonstrated significant improvement in overall efficiency through a novel package that moves the phosphor away from the die. Moving the phosphor away from the semiconducting element leads to improved life compared to traditional white LED packages. By combining improvements at the device and packaging levels, the two teams hope to achieve an efficiency target that far exceeds any commercial white LED.

One of the LRC's prototype LED lighting packages.

Sponsors

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