

ENERGY, RESOURCES, & NONPROLIFERATION

Leading a new center for solid-state lighting

Dramatic changes are unfolding in lighting technology as semiconductor light-emitting diodes, or LEDs, have become as bright and efficient as incandescent bulbs. Until recently LEDs were used mainly as simple indicator lamps in electronics and toys, but now they are beginning to replace incandescent bulbs in many applications, such as traffic, automotive, display, and architectural area lighting. Applications requiring durability, compactness, cool operation, and directionality are all LED candidates.

In 2006, U.S. DOE Secretary Samuel W. Bodman announced an effort to further this technology shift by naming Sandia as the new home of the National Laboratory Center for Solid-State Lighting Research and Development.

Sandia will conduct solid-state lighting research and coordinate related efforts at several other national laboratories. Sandia also continues to work with leading universities and private industry in this research area.

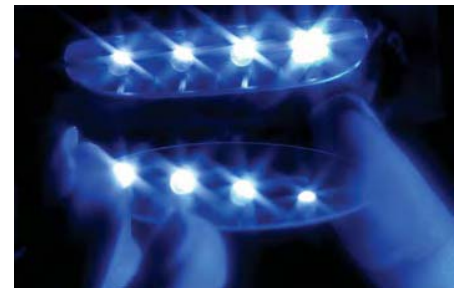
DOE will provide \$5 million for seven research projects in solid-state lighting through the Office of Energy Efficiency and Renewable Energy.

The research will be conducted through the Center for Integrated Nanotechnologies (CINT), jointly operated by Sandia and Los Alamos National Labs, and four other DOE nanotechnology centers around the country. New LED technologies “offer excellent prospects for meeting our future lighting needs in a less costly, more efficient way than today’s incandescent and even fluorescent fixtures,” Bodman said. The research area also presents an opportunity to assume a leadership role in an emerging industry, he said.

Research is centering on several key challenges, including:

- Understanding of the physics of LED materials and nanostructures,
- Improving optoelectronic devices for efficient photon generation and extraction,
- Improving packaging technologies for high-power lamps,

- Developing new wavelength-conversion and color-mixing technologies for generation of white light,
- Designing new lighting fixtures and systems, based on the unique ways people can interact with solid-state lighting, and
- Developing a science and technology foundation for high-volume, low-cost manufacturing.



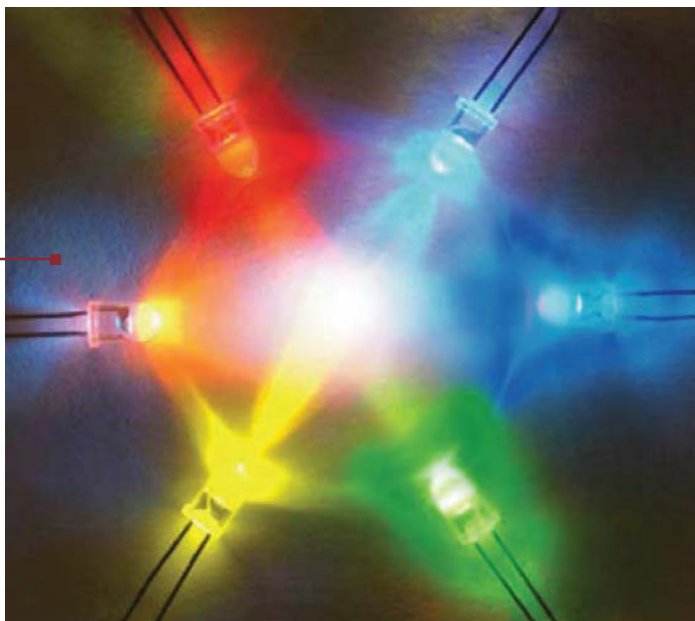
Researchers believe further major LED improvements are achievable. Electrical-to-optical energy conversion efficiencies of more than 50 percent have been achieved in infrared light-emitting devices. If similar efficiencies can be achieved in visible light emitting devices, the result would be a white light source twice as efficient as fluorescent lamps, and 10 times more efficient than incandescent lamps.

Such a new source would:

- Reduce electricity for lighting worldwide by more than 50 percent,
- Reduce total consumption of electricity by 10 percent,
- Reduce carbon emissions, and new capital infrastructure associated with electricity generation, also by 10 percent,
- Enhance the human viewing experience through digital and independent control over the color, intensity, and spatial distribution of lights, and
- Further the development of compact visible and UV light sources, for water purification and detection of bioagents.

Mixing of light from LEDs of multiple colors to create white with high color-rendering quality.

Courtesy of Fred Schubert, RPI



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sandia.gov/news/resources/releases/2006/led-center