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Organic lighting research burns bright

The long, challenging technological march from the low-power light bulb Thomas Edison invented to the ultimate in a bright and energy-efficient lighting device may reach fruition in work led by the two ASU researchers.

A recent cover story in the journal *Advanced Materials*, a leading materials and device engineering research publication, details advances in the use of organic light-emitting diodes (OLEDs) by Ghassan Jabbour and Jian Li, with help from graduate students Evan Williams and Kirsi Haavisto, a Fulbright scholar from Finland.

Jabbour is a professor and Li is an assistant professor in the new ASU School of Materials, which is jointly administered by the Ira A. Fulton School of Engineering and the College of Liberal Arts and Sciences. Jabbour also is director of optoelectronics research and development at the Flexible Display Center at ASU.

The two have developed an organic lighting device with "100 percent internal quantum efficiency" by employing newly designed host materials coupled with optimized device architecture.

Internal quantum efficiency involves the number of photons generated inside the device per each electron from the electricity source – such as a battery.

What's particularly significant about the researchers' work is that their optimized device adopts an even simpler structure than any yet reported by other research groups.

"There is no waste of electricity," Jabbour says. "All the current you are putting into the device is being used to produce light. It's the first time something like this has been demonstrated. Nobody else has shown a 100 percent internal quantum efficiency for lighting devices using a single molecular dopant to emit white light."

The achievement promises significant progress in the development of solid-state lighting based on OLED technology that can be manufactured at low costs.

Such devices also could provide a major source for progress in global environmental efforts to conserve energy and natural resources. In addition to progress in energy conservation, the work also could accelerate advances in semiconductor technology materials through improvements in low-power organic thin-film transistors, an area Jabbour and Li's group is researching intensely.

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