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TECHNOLOGY UPDATE

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Hybrid WLEDs get brighter

High-quality, bright white LEDs for the solid-state lighting market might soon become a reality thanks to new devices made by researchers in Turkey and Germany. The hybrid LEDs, which are made from highly luminescent nanocrystals and highly fluorescent polymers, are the first to allow controlled white light generation with a high colour rendering index (CRI) of greater than 80. The LEDs could be used in any of the situations where light bulbs and fluorescent strips are used today, offering significant savings in electricity consumption. In the future, such devices may even help provide low-cost, safe lighting in areas that have no access to electricity.

About 20% of global electricity production is used for lighting. Solid-state lighting could cut this figure in half. Moreover, about a third of the world's population (about two billion people) has no access to electricity and relies on fuel-based lighting, which is unhealthy, expensive and has a low CRI (poor light quality and low colour purity). The Light Up the World Foundation strongly recommends using WLEDs and a worldwide effort is now underway to develop high-quality devices.

Fluorescent lamps (or so-called energy saving light bulbs) offer a 30% reduction in energy loss compared to incandescent light bulbs, which can lose up to 90% of their energy. However, these devices cannot be dimmed very easily. In contrast, the light generated by WLEDs can be tuned by design, which means that they could replace traditional lamps as the lighting devices of choice.



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Elisabeth Holder of the University of Wuppertal and Hilmi Volkan Demir of Bilkent University in Ankara and colleagues, have now taken a major step forward in this direction. The researchers generated white light in devices made from a blue conjugated polymer as an organic host for coloured inorganic nanocrystals. "Together these components generate white light of a very high quality when pumped by a very efficient inorganic LED," Holder told *nanotechweb.org*.



H V Demir

The white light generation is tuned using layer-by-layer assembly of closely packed cadmium selenide/zinc sulphide core-shell nanocrystals and polyfluorene-conjugated polymer hybridised on near-UV emitting nitride-based LEDs. The WLEDs are the first to have CRIs of greater than 80, the figure required for future solid-state lighting applications. "Today, most commercial WLEDs typically have colour rendering indices of around 70, but this is not as high as desired," explained Demir. "This is the basic motivation for our work to use a combination of nanocrystals in polymers."

Holder continued: "LEDs have become very popular in lighting applications due to the fact that they are able to save about 80% of the energy costs compared to standard light bulbs. LED lighting could be important in all areas but mainly in indoor lighting where soft white light is preferred."

The team now plans to use more efficient conjugated polymers to allow "triplet emitting channels". It will also optimise the morphology of the devices by employing polymers that allow the nanocrystals and polymers to be closer together in the finished LEDs.

The work was published in *New Journal of Physics*.

About the author

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