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Nanocrystal-Coated LEDs Emit Pure White Light

Researchers create ultra-efficient LED

LEDs are some of the most efficient energy conversion devices available on the market today. No only that, but they can also be made to shine a wide range of different colors in the visible and infrared spectrum, and have way longer lives than traditional light bulbs and florescent tubes. This is mostly why LEDs are considered to be the future of efficient lighting, helping reduce the electric energy consumption, thus the carbon dioxide and other greenhouse gas emissions. However, their current design is flawed by the fact that they have 'color rendering indexes' ranging between 80 to 100, while the florescent light tubes have indexes of 100. This basically means that most LEDs shinning white light are actually tending to acquire a bluish tinge, thus objects lit with such light appear to have pure color, but in fact they do not. A team of researchers from the University in Ankara discovered that by coating the semiconductor core crystals with a nanocrystal structure, they can generate a light emission in the desired spectrum. White light electroluminescent diodes are usually made of a semiconductor chip, consisting of a core of cadmium selenide surrounded by a layer of zinc sulphide. As they are being powered, LEDs absorb part of the blue light into the semiconductor crystal, but let the red and green wavelengths to pass right through it. The green and red light combine with the remnant blue, in order to produce an emission of soft white light. On the other hand, commercially available LEDs use phosphor coatings to convert part of the light in the blue spectrum into yellow light, which when mixed with the remaining blue light it gives off an annoying blue-hued white. The problem with the phosphor coating is that it cannot be tunned to emit or absorb a specifically required amount of light. By using nanocrystals, Hilmi Volkan Demir was able to obtain a more tight rage of wavelengths than in the case of the phosphorus coating, meaning that they can be made to emit light in any desired spectrum. But by combining different-sized nanocrystals, one can control the emissions of green and red light, which combine to form blue light and obtain a pure white color. This ultimately translates into a more efficient energy conversion. For example, phosphorus-coated white LEDs can provide about 30 lumens per watt, florescent tubes output about 60 lumens per watt, while the traditional light bulb is able to give only 15 lumens per watt, meaning about 10 percent of the inputed energy, the rest being spent on heat. However, the white nanocrystal LEDs can provide 300 lumens of light per watt.