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Environmentally affordable fluorescent nanotechnology for efficient lighting

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A novel nanotechnology for environmentally benign as well as efficient white light generation is developed. Compared to conventional phosphors that overly rely on rare-earth elements (REEs), this proposed nanotechnology is REE free and is instead based on the integration of II-VI semiconductor nanoparticles and polymeric materials. ZnO and ZnS:Mn nanoparticles are combined with poly(9,9-di-n-hexylfluorenyl-2,7-diyl) to create efficient warm-light-emissive nanocomposites. The resultant nanocomposites encompass three different photon-generating routes, which can lead to blue, green and orange emissions, respectively. White light thus can be directly generated from the nanocomposites as pumping by commercial UV- or blue-LED. Moreover, a wide tunability of color temperatures ranging from below 3000K to 6000K, which embraces both candle light and white light, is achievable by the nanocomposite. A warm-white light emission with above 90% high quantum efficiency has also been demonstrated under the commercial UV-LED excitation. Additionally, we successfully explore an innovative technique to synthesize II-VI-based nanoparticles without quantum-confinement effect. The prepared nanoparticles can exhibit a strong absorption at 453 nm, which well fits the wavelength of commercial blue-LEDs (450-460 nm), and efficiently convert blue light to brightly orange light. The proposed nanoparticle-based technology can serve as a promising solution not only to the health issues involved in current blue-LED-YAG lighting systems, but also to the eco-friendly affordable efficient-lighting technology.

Biography

Ching-Fuh Lin obtained the BS degree from National Taiwan University in 1983, MS and PhD degrees from Cornell University, Ithaca, NY, in 1989 and 1993, respectively, all in electrical engineering. He is now the Director of Innovative Photonics Advanced Research Center (i-PARC) and a joint distinguished Professor in the Graduate Institute of Photonics and Optoelectronics, Graduate Institute of Electronics Engineering, and Department of Electrical Engineering at National Taiwan University. His major research area is in photonics, including organic-inorganic composites for light-emission devices and solar cells, single-crystal Si thin-film solar cells, Si-based photonics, and physics in broadband semiconductor lasers and optical amplifiers. He is a Fellow of IEEE, a Fellow of SPIE, Member of Asia-Pacific Academy of Materials, and a member of OSA. He has published over 160 journal papers and 460 conference papers and holds more than 60 patents. He is also the sole author of two books. He obtained the Distinguished Research Award and several Class A Research Awards from National Science Council of Taiwan, ROC, and the Outstanding Electrical Engineering Professor Award from the Chinese Institute of Electrical Engineering.

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