Semiconductor Quantum Dots for White Light Generation

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In the field of lighting, three general approaches are being investigated for producing white light using solid state devices. The wavelength conversion approach utilizes a UVLED to excite red, green, and blue phosphors. In the color mixing approach, white light is generated by mixing light from red, green, and blue LEDs. The hybrid approach combines a blue LED to excite green and red phosphors. Luminescent nanocrystals or quantum dots are being considered as alternatives to conventional, bulk phosphors. Semiconductor quantum dots exhibit tunable photoluminescence emission based on their diameter and surface chemistry, and exhibit a small Stokes shift. Quantum dots are capped with organic ligands and stabilized in solvents such as hexane, toluene, and pyridine. For practical use, the quantum dots may be incorporated into polymers or used as evaporated films. This work investigates the optical properties of quantum dots under near-UV to visible excitation (370-460 nm), and the effects of surrounding media on quantum dot luminescence. Some of the challenges in the integration of these materials with LEDs will be discussed.

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