Abstract

Colloidal quantum dots have attracted significant interest in recent years for lighting and display applications and have recently appeared in high-end market products. The integration of quantum dots with light emitting diodes has made them promising candidates for superior lighting applications with tunable optical characteristics. In this work we propose and demonstrate high quality colloidal quantum dots in their novel free-standing film forms to allow high quality white light generation to address flexible lighting and display applications. High quality quantum dots have been characterized using transmission electron microscopy, x-ray diffraction, x-ray photoelectron spectroscopy, steady state and time resolved photoluminescence and dynamic light scattering methods. The engineering of colloidal quantum dot composition and its optical properties in stand-alone film form has led to the experimentally high NTSC color gamut of 122.5 (CIE-1931) for display applications, color rendering index of 88.6, luminous efficacy of optical radiation value of 290 lm/W_{opt} and color temperature of 2763 K for lighting applications.