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Effect of polymer Particle Size in CdSe-Polystyrene Nanocomposites Fluorescence Emission

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The development of photoluminescent materials based on the incorporation of quantum dots (QDs) into polymeric latexes has gained importance due to the multiple potential applications. Through the process of miniemulsion polymerization it is possible to encapsulate quantum particles, in a polymer matrix, to provide both chemical stability and to maintain emission properties. At the same time, by changing the synthesis variables it is possible to modifying the polymer particle size, which in turn, produces changes in both the ratio QDs/polymer particle and the fluorescent emission intensity.

Miniemulsión polymerization process was achieved with continuous magnetic stirring and nitrogen atmosphere. Cetyl trimethylammonium bromide (CTAB) was used as the surfactant at concentration levels of $1.3x10^{-3}$, $3.2x10^{-3}$ and $5.4x10^{-3}$M. The initiator 2,2-azobisisobutyronitrile (AIBN) and CdSe QDs were used at 0.50 and 0.75 wt% and 0.075, 0.15 and 0.225 wt%, both with respect to monomer content, respectively.

Firstly, a STEM study on the composite latexes and later a statistical study on the measurement of polymer particle diameter, let us to corroborate that increments in surfactant concentration produces decrements in polymer particle size. The obtained composite latexes were stable and showed fluorescence by excitation with UV light. The spectrofluorometry studies indicated that composite latexes fluorescent emission was a function of polymer particle size, showing higher intensity those formulations with higher concentrations of initiator and smaller polymer particle size. All formulations presented a relatively narrow emission profile; a condition that may be indicative of highly monodisperse polymer particles (1). Besides, the maximum excitation energy in the different samples showed no changes, which can be considered as an excellent quantum confinement (2) (Figure 1).

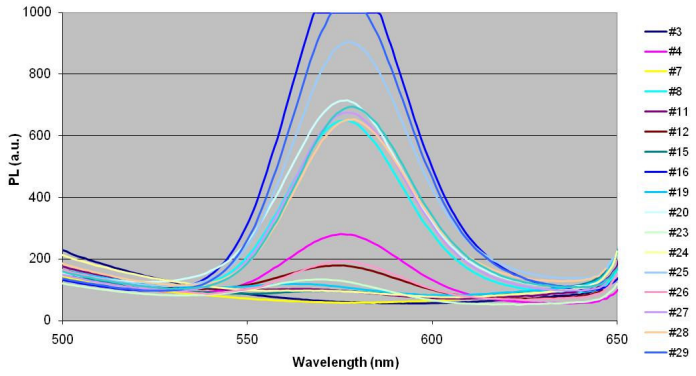

Figure 1. Photoluminescent emission spectrum of CdSe-polystyrene nanocomposites.

(1) Sharma H. et al., Colloid Polymer Science (2007) 285: 1213-1227.

(2) Khanna P.K. and Singh N., Journal of Luminescence (2007) 127, 474-482.