Self-Organized Lead(II) Sulfide Quantum Dots Superlattice

Resumo
We show that superlattice (SL) of PbS quantum dots (QD) can be easily prepared by drop casting of colloidal QD solution onto glass substrate and the ordering level can be controlled by the substrate temperature. A QD solution was dropped on glass and dried at 25, 40, 70 and 100 degrees C resulting in formation of different SL structures. X-ray diffractograms (XRD) of deposited films show a set of sharp and intense peaks that are higher order satellites of a unique peak at 1.8 degrees (two theta), which corresponds, using the Bragg’s Law, to an interplanar spacing of 5.3 nm. The mean particles diameter, calculated through the broadening of the (111) peak of PbS using the Scherrer’s formula, were in agreement with the interplanar spacing. Transmission electron microscopy (TEM) measurements were also used to study the SL structure, which showed mainly a face centered cubic (FCC) arrangement of the QD. The photoluminescence (PL) spectrum of QD in the SL showed a shift toward lower energy compared to one in solution. It can be attributed to the fluorescence resonant energy transfer (FRET) between neighbors QD’s. Moreover, we observed greater redshift of PL peak for film with lower drying temperature, suggesting that it has a more organized structure. (AU)