

Nanocomposites and nanomaterials

CdTe quantum dots embedded into the ionic crystals

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We report the fabrication of composites based on colloidal quantum dots (QD) incorporated into conventional salt crystals. NaCl, KCl, KBr, $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ and KH_2PO_4 matrices have been recently used as a host of semiconductor CdTe nanocrystals (NCs).

The CdTe NCs synthesis was carried out by Cd^{2+} and Te^{2-} ions interaction in aqueous solutions in presence of the thioglycolic acid ($\text{pH}=11.2$). Light yellow CdTe colloidal solution was heated at 100°C during 2 h. The incorporation of CdTe NCs into the ionic crystals was performed by the mixing of a saturated salt solution with a QD solution. The solutions were stored under ambient conditions for periods of 5-10 days so the slow evaporation of water, oversaturation, and consequently, crystallization took place. NaCl and KCl, saturated solutions were used at room temperature. KBr, $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ and KH_2PO_4 solutions used for crystallization at room and at an elevated temperature, since its solubility increases rapidly from 20 to 100°C . The formed crystals were filtered from the parental solution, rinsed with cold ethanol and dried.

UV-vis absorption spectra and photoluminescence (PL) measurements were recorded using spectrophotometer USB Ocean 650 with a range of 380 - 900 nm. Optical microscope Orthoplan with UV filters-set was used to investigate the process of salt crystallization in the presence of CdTe NCs. For this purpose, few drops of mixed saturated salt and CdTe NCs solutions were put on the glass slide and video of the incorporation of QDs into ionic crystals was recorded by the digital camera Olympus E-3.

We note that, in cases of $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ and KH_2PO_4 the QDs had relatively low stability and precipitation of CdTe aggregates occurs. In cases of NaCl, KCl, KBr the formed macrocrystals were colored due to the incorporation of QDs. Salt shell protects the QDs from the environment and should offer high photo and chemical stability. The mixed crystals preserve the strong luminescence of the incorporated QDs.

