

"Nanocomposites and nanomaterials"

Selective incorporation of CdTe/CdS nanoparticles into the KH_2PO_4 monocrystals

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CdTe quantum dots (QDs) are perspective luminophors for optoelectronic devices, but their practical application requires solid state composites, stable at high temperatures and under intense radiation.

Here, we report production and investigation of solid-state luminescent composites via incorporation of CdTe/CdS QDs into salt monocrystals of KH_2PO_4 (KDP). KDP matrix has nonlinear optical properties and it's widely used in optoelectronics. CdTe/CdS QDs have a set of unique optical properties and demonstrate a luminescence with emission colors covering green to red spectral regions.

KDP:CdTe/CdS composites were produced by slow evaporation of solvent from a mixture of saturated solution of salt and colloid of QDs at the ambient conditions. It has been determined the QDs are incorporated into the crystal selectively into the pyramidal face {101}. Because CdTe/CdS nanoparticles are negatively charged, they are selectively absorbed on positively charged {101} facets. From this observation we can conclude that the mechanism of QDs incorporation into KDP monocrystals has an electrostatic nature. In the process of QDs absorption on the facet {101} of a growing crystal, the QDs are attached to the surface and are overgrown by the matrix, finally trapped inside the crystal.

Optical properties of composites KDP:CdTe/CdS were investigated and small blue shift of photoluminescence peak of CdTe/CdS QDs is observed during transferring of QDs into the KDP matrix. Also, PXRD data's shows that the incorporation of nanoparticles almost hasn't effect on structural perfection of crystal. Studying of chemical and thermal stabilities of composites shows that after holding at 100°C during 3 hours composites did not lose luminescence and after holding of composites during 3 months in benzoyl peroxide luminescence of KDP:CdTe/CdS don't change.

The composites exhibit anisotropic photoluminescence properties, due to the protection of the tight matrix, good thermal and chemical stability and KDP matrix practically don't impact on optical properties of embedded CdTe/CdS QDs.