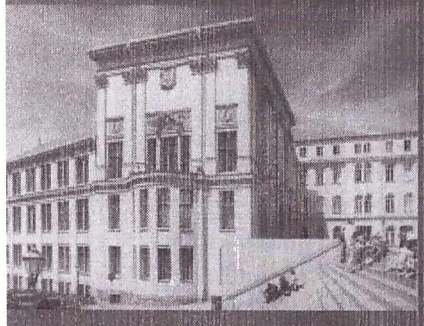

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Luminescence properties of PbI_2 nanometer-sized particles embedded in CdI_2 matrix

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Layered compounds of CdI_2 and PbI_2 have isomorphic structure and similar lattice parameters: $a = 4.24$ Å, $c = 6.84$ Å; $a = 4.56$ Å, $c = 6.96$ Å, respectively. 4H-polytype is the most common for CdI_2 and 2H-polytype - for PbI_2.

Lead iodide nanometer-sized structures formed in CdI_2-PbI_2 crystal system with impurity content from 10^{-5} to 5 mol % are studied by luminescence spectroscopy in the temperature range 4.2 – 150 K and atomic-force microscopy methods. It has been shown that PbI_2 nanoparticles are located in the plane of cadmium iodide layer and also along the linear defects of the structure.

Existence of the two types of nanocrystalline impurity centres with the same 4H-PbI_2 structure, but different spectral characteristics is established by the luminescence measurements.

The first type of centres exhibits luminescence which is excited in the fundamental absorption region and in the band of small-radius impurity exciton (3.23 eV) as well [1]. Their photoluminescence spectra in various temperature ranges depend on the exciton interaction with phonons and defects of crystal structure. Other centres reveal one photoluminescence band 2.14 eV excited in both cadmium iodide and lead iodide fundamental absorption region and low-energy band edge of the impurity exciton (3.16 eV).

We suggest that the luminescence centres of the first type are associated with PbI_2 nanocrystals and the energy transfer to them is realized predominately by the excitonic mechanism. Obviously, the centres of the second type arise due to PbI_2 nanocrystals located along the linear defects of CdI_2 structure and the electron-hole mechanism prevails in their excitation.

Isolated Pb^{++}-centres, as we suppose, are responsible for the photoluminescence band 2.25 eV. According to the results of X-ray analysis only one third of PbI_2 embedded in CdI_2 lattice exists in the molecular state, what confirms our conclusion.

[1] I. M. Bolesta, V. V. Vistovsky, N. V. Gloskovskaya, M. R. Panasyuk, L. I. Yarytskaya. *Phys. Solid State* **53**, 799 (2011).