Nanocomposites and nanomaterials

Relationship of CdI_2-PbI_2 photoluminescence with optically generated recombination centers

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In this work, we study CdI_2 crystals of different polytypic modification with PbI_2 content of ~0.0001 mol.% grown from the melt (I) and obtained by diffusion from the gas phase (II). Luminescence was excited by synchrotron radiation at 8 K.

According to the results of atomic force microscopy, PbI_2 impurity is embedded in the CdI_2 crystal lattice in the form of nanocrystalline inclusions. The possibility of heterojunction between these isomorphic crystals was proved [1]. Luminescence properties of such system are based on the features of the narrow-band component - PbI_2. Photoelectret state investigations in CdI_2-PbI_2 system enabled us to identify two donor and two acceptor trapping levels with optical depth of 0.43; 0.57 eV and 0.68; 0.9 eV, respectively [2].

Reported EPR results for PbI_2 crystals [3] allowed to associate donor centers with the neutral lead atoms in 4H and 2H polytypes of PbI_2. The models of neutral iodine atoms, bound with one and the same lead ion, were proposed for acceptor centers. Photoluminescence bands of 2.14 and 2.0 eV arise due to the electron recombination luminescence; 1.87 and 1.63 eV bands are related with the hole one.

We associate 2.47 and 2.39 eV emission bands with self-trapped cationic exciton relaxation in the presence of single-charged lead ions in 2H- and 4H-modifications, respectively.

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2. *Galchynsky O.V., Gloskovskaya N.V. and Yarytska L.I.* Deep acceptor trapping centers in CdI_2-PbI_2 crystal system. // Functional materials.-2014.-**21**, N 3 (in print).
3. *Arends J., Verwey J.F.* ESR on UV irradiated lead halides at 80 K. // Phys. Stat. Sol.-1967.-**23**.-P. 137-145.