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Investigation of regularities of photoluminescence centers formation in Fe²⁺ doped CVD-ZnSe by the two-photon confocal microscopy method

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ZnSe crystals doped by Fe²⁺ are used as an active medium of lasers operated in the 3.5-5 μm spectral range. The characteristics of the medium important for laser applications depend not only on the nature and concentration of the doping component, but to a great extent on the type of the intrinsic or impurity defects of material. Such defects are defined by the conditions of crystal growth and also by the subsequent high temperature treatment, employed for matrix doping by active impurities. In this work, the unique technique of doping was developed and CVD-ZnSe samples with different Fe²⁺ concentration profiles were manufactured. The effective concentration of Fe²⁺ ions was at the 10¹⁹ at/cm³ level. The two-photon confocal microscopy method was used for investigating the nature and character of changes in the distribution of band-to-band and defect-impurity photoluminescence (PL) centers directly in the bulk of Fe²⁺: ZnSe polycrystals. The two-photon excitation was realized by a laser operated in the 0.75-1 μm range at room temperature, the PL spectra were registered in the 425-725 nm range. As a result, the PL "volume" maps of Fe²⁺: ZnSe polycrystalline samples were recorded reaching a depth up to 1 mm with a step 25 μm and a size of plane area 1x1 mm. The investigation of the maps reveals the regularities of PL centers formation in the bulk and at grain boundaries in the polycrystalline CVD-ZnSe due to the concentration of Fe²⁺ ions. The work was supported by the RSF grant №15-13-10028.

Biography

N A Timofeeva has received the degree of MSc at R.E. Alekseev Nizhny Novgorod State Technical University, Russia. She is currently doing her PhD program at G.G. Devyatykh Institute of Chemistry of High-Purity Substances, Russian Academy of Sciences. The PhD focuses on the synthesis of polycrystalline zinc chalcogenides ZnSe and ZnS doped by iron for active medium of solid-state lasers. She has 7 publications in this field.

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