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Luminescent properties of radiation induced defects in sodium and magnesium fluorides nanocrystals

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ABSTRACT

The possibility of formation of radiation defects with new luminescent properties is investigated in sodium and magnesium fluorides nanosized crystals. Nanocrystals obtained by mechanical fragmentation of the single crystals have been irradiated by γ -rays at 77 K or electron beams at room temperature. Their TEM images have been received. Luminescence, luminescence excitation and absorption spectra of nanocrystals have been measured immediately after γ -irradiation without samples defrosting and after termination of the defects aggregation processes at room temperature. The formation of radiation color centers with previously unknown optical characteristics has been discovered in nanocrystals. Numbers of anion vacancies and electrons entering into these centers composition were established in sodium fluoride. The structure transformation of the centers, containing two anion vacancies and an electron, was revealed after sodium fluoride samples defrosting. For sodium fluoride the data on the Huang-Rhys parameters and lifetimes of the photoluminescence for here studied and previously known centers of the same composition are determined and compared. The results obtained show that near-clusters color centers can be formed in crystals with different structures and atomic compositions.

Keywords: Sodium fluoride; Magnesium fluoride; Nanocrystals; Radiation defects; Luminescence; Electron-phonon interaction.

1. Introduction

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