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Photoluminescence of swift heavy ion irradiated MgAl2O4 spinel single crystals

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In the present work, swift heavy ion irradiation-induced defects in MgAl2O4 single crystals have been studied using photoluminescence (PL) spectroscopy technique. Samples were irradiated with high energy Ar (46 MeV), Kr (107 MeV), Xe (150 MeV) and Bi (710 MeV) ions in the fluence range of 10^10-10^14 cm-2 at IC-100 and U-400 cyclotrons in FLNR JINR (Dubna, Russia). The PL measurements were performed in two experimental geometries: standard (λexc. = 355 nm) using Shamrock SR303i spectrometer and confocal (λexc. = 355 nm, 445 nm, 473 nm and 532 nm) using confocal microscope at room temperature. It was found that the PL spectra from intact MgAl2O4 contain emission bands of Cr3+ (1.8 eV) and Mn2+ (2.4 and 1.6 eV) impurities. Irradiation of MgAl2O4 crystals by high-energy heavy ions causes the appearance an intense non-elementary bands around 1.55-3.1 eV under 355 nm, 445 nm, 473 nm and 532 nm excitation wavelengths. The analysis of the PL spectra obtained in standard geometry allowed us to assume that the radiation-induced defects created in the track region are surrounded predominantly by Mg and O ions. In confocal geometry, upon different energy of excitation, the PL spectra of samples have been demonstrated the similar spectral shapes, which have been tentatively ascribed to some of impurity centers in different charge states.

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