

Vacuum ultraviolet absorption and ion track effects in LiF crystals irradiated with swift ions

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LiF crystals were irradiated with various light and heavy ions (Ni, Zn, Au, Pb, Bi, and U) of MeV to GeV energy. The radiation damage was studied by optical spectroscopy from the vacuum ultraviolet to the visible spectral region and by small angle x-ray scattering, in combination with optical bleaching and thermal annealing. In addition to the well-known electron centers (F and F_2 centers) and the hole centers responsible for the previously observed band at 114 nm, a new absorption band was observed at 121 nm. The new band appears prominently in crystals irradiated with the heaviest projectiles (Au, Pb, Bi, U), is small for Zn ions, insignificant for the lighter Ni ion and absent in case of gamma irradiation. Under optical bleaching, F - and 114-nm centers are destroyed whereas the 121-nm band is relatively stable. The decay of the 121-nm band on thermal annealing coincides with the reduction of the small-angle x-ray scattering signal. It is considered that the 121-nm band is directly linked to hole-center clusters complementary to the electron-center aggregates in the core region of ion tracks. Evidence is presented to associate an absorption band at 275 nm formed after thermal annealing with the formation of small quasi-colloidal aggregates.