Radiation defects in lithium fluoride induced by heavy ions

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Single crystals of lithium fluoride were irradiated with various species of heavy ions in the energy regime between 1 and 30 MeV/u. The induced radiation damage was studied with techniques such as optical absorption spectroscopy, small-angle *X*-ray scattering, chemical etching and profilometry, complemented by annealing experiments. Clear evidence is given for a complex track structure and defect morphology. Single defects such as *F*-centers are produced in a large halo of several tens of nanometers around the ion trajectory. The defect creation in this zone is similar to that under conventional radiation. For heavy ions above a critical energy loss of 10 keV/nm, new effects occur within a very small core region of 2-4 nm in diameter. The damage in this zone is responsible for chemical etching and for a characteristic anisotropic *X*-ray scattering. It is assumed that in this core, complex defect aggregates (e.g., cluster of color centers, molecular anions and vacancies) are created. Their formation is only slightly influenced by the irradiation temperature and takes place even at 15 K where diffusion processes of primary defects are frozen.
Furthermore, irradiation with heavy ions leads to pronounced swelling effects which can be related to an intermediate zone of around 10 nm around the ion path.