

Scanning force microscopy of heavy-ion induced damage in lanthanum fluoride single crystals

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Lanthanum fluoride (LaF_3) is an optically transparent solid with a hexagonal lattice and a band gap of approximately 10.3 eV. Due to its properties, this material may be associated with a group of ionic crystals, such as LiF and CaF_2 , whose response to heavy-ion irradiation as a function of crystalline structure, content of fluorine, irradiation temperature, and other parameters has been studied intensively. This work reports first scanning force microscopy (SFM) observations of damage induced by energetic heavy ions on the surface of LaF_3 . Single crystals were irradiated at normal incidence with heavy ions (Ne, Ni, Zn, Xe and U) in the MeV to GeV regime at the linear accelerator UNILAC of GSI. Subsequently, the surfaces were inspected by SFM in ambient air, simultaneously recording topographic and lateral-force images. These micrographs visualize the generation of tiny hillocks on the nanometer scale, in accordance with similar findings for other ionic crystals. The mean hillock diameters and heights both show a significant increase as a function of ion energy loss.