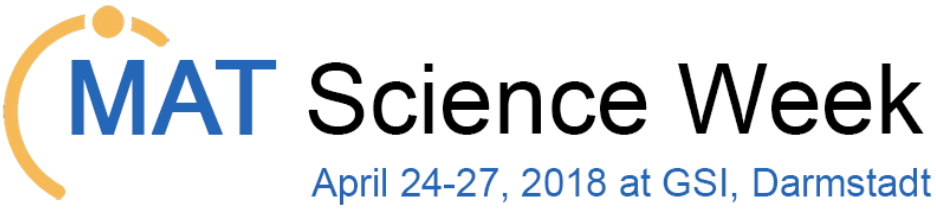

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Structural and mechanical properties modifications induced in α-Al2O3 under swift heavy ions

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Sapphire is a common substrate for a broad variety of materials due to its optical transparency, insulating property and its hexagonal structure allowing often an easy epitaxial growth. During the use in radiative environment, such as space or nuclear industry, the materials intrinsic properties can be modified. Indeed, investigating the behavior of sapphire substrate under ion irradiation and its potential influence on the features of the epitaxial top layer is crucial for a reliable use.

In this work, mechanical properties and structural modifications induced by swift heavy ion irradiation are investigated. (0001)-Al2O3 single crystals have been irradiated along the c-direction by 92 MeV 129Xe at different fluences at GANIL (Caen, France). HRXD and nanoindentation combined with confocal microscopy have been used to characterize samples.

The evolution of the X-Ray patterns and of the mechanical properties are discussed as a function of the fluence. Lattice parameter variations are linked to disorder formation and amorphization. A depth profile is suggested as an explanation for the structural behavior. Correlated to the crystallographic disorder, a decrease in elastic modulus and hardness is observed. It has also be noted an influence of the ion irradiation on the shape of residual indents and on the morphology of the cracks. Complementary RBS/c, Raman spectroscopy and TEM results are discussed for a better understanding of the physical modifications under irradiation.

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