

Out-of-plane swelling of gadolinium gallium garnet induced by swift heavy ions

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Single crystals of gadolinium gallium garnet ($\text{Gd}_3\text{Ga}_5\text{O}_{12}$) have been irradiated with various ions (Cr 10.6 MeV/u, Cu 0.8 MeV/u, Kr 9 MeV/u, and Pb 4 MeV/u) in the electronic stopping power regime. The irradiated areas of the crystals exhibited a pronounced volume expansion.

Using a profilometer, the out-of-plane swelling was measured by scanning over the border line between an irradiated and virgin area of the sample surface. The step height varied between 25 and 160 nm depending on the fluence, the electronic stopping power and the total range of the ions. In the high fluence regime, the swelling effect approaches saturation.

In order to compare the results obtained for different ion species, the initial swelling per ion was normalised by the length of the damage track. Such an analysis makes evident that swelling occurs only above a critical energy loss of 7 ± 2 keV/nm. The results of $\text{Gd}_3\text{Ga}_5\text{O}_{12}$ will be compared with data obtained earlier in SiO_2 and LiNbO_3 .