Electronic sputtering of $Gd_3Ga_5O_{12}$ and $Y_3Fe_5O_{12}$ garnets: Yield, stoichiometry and comparison to track formation

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The results of present paper have shown that sputtering of yttrium iron garnet ($Y_3Fe_5O_{12}$) under swift heavy ions in the electronic energy loss regime is non-stoichiometric. Here we are presenting additional experimental results for gadolinium gallium garnet ($Gd_3Ga_5O_{12}$) as target. The irradiations were performed with different ions (^{50}Cr (589 MeV), ^{86}Kr (195 MeV) and ^{181}Ta (400 MeV)) impinging perpendicularly to the surface. As earlier, the sputtering yield was determined by collecting the emitted gadolinium and gallium atoms on a thin aluminium foil, placed upstream above the target and analyzing the Al catcher by Rutherford backscattering. Also for $Gd_3Ga_5O_{12}$, the emission of Gd and Ga is non-stoichiometric. Sputtering appears above a critical electronic stopping power of S_{th} = 11.6 ± 1.5 keV/nm, which is larger than the threshold for track formation, in agreement with other amorphisable materials. In addition, the angular distribution of the sputtered species was measured for $Y_3Fe_5O_{12}$ and $Gd_3Ga_5O_{12}$ using 200 MeV Au ions impinging the surface at 20° relatively to the surface. For the two garnets the ratio of Y/Fe (and Gd/Ga) varies with the angle of emitted species and the stoichiometry seems to be preserved only for an emission perpendicular to the surface.