

## Electronic sputtering of metals and insulators by swift heavy ions

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Angular distributions and total yields of atoms sputtered from crystals of LiF and  $\alpha$ -SiO<sub>2</sub> quartz and from Ti, Zr and Au targets are measured under the irradiation of different heavy ions in the electronic energy loss ( $S_e$ ) regime. The angular distributions for Si atoms sputtered from SiO<sub>2</sub> are nearly isotropic ( $\sim \cos \theta$ ), whereas all metallic targets follow an overcosine law ( $\sim \cos^3 \theta$ ). In case of LiF, an isotropic distribution is found to be superimposed by an anisotropic jet-like component peaked normal to the sample surface. The sputter yield of different targets varies by several orders of magnitude from 10 for metals to 10<sup>5</sup> for LiF. As a function of the electronic energy loss of the projectiles, the total sputter yield follows a  $(S_e)^4$  law for LiF. Experimental sputter yields are analyzed within the inelastic thermal spike approach. Good agreement is obtained for  $\alpha$ -SiO<sub>2</sub> when using the same set of parameters which successfully describe track formation. To model sputtering yield in metals, both contributions of electronic and nuclear collisions have to be taken into account. The sputtering mechanism of LiF seems to be more complex, possibly combining a hydrodynamic process generated by a transient thermal effect associated with a decrease of the surface binding energy.