EFFECT OF IMPACT ANGLE AND PROJECTILE SIZE ON SPUTTERING EFFICIENCY OF SOLID BENZENE INVESTIGATED BY MD SIMULATIONS

Bartlomiej Czerwinski[a)] (bartlomiej.czerwinski@uj.edu.pl), Lukasz Rzeznik[b)], Robert Paruch[b)], Barbara J. Garrison[c)], Zbigniew Postawa[b)]

[a] *Goszczynski College, pl. Krasińskiego 1, 34-400 Nowy Targ , Poland*
[b] *Smoluchowski Institute of Physics, Jagiellonian University, ul. Reymonta 4, 30-059 Kraków, Poland*
[c] *Department of Chemistry, The Pennsylvania State University, University Park, PA 16802, USA*

Molecular dynamics computer simulation is used to investigate the effect of projectile size and impact angle on the efficiency of surface erosion. 14.75 keV argon clusters Ar_n (n=366, 872, 2953, 9000) are directed at the surface of a coarse-grained solid benzene crystal at angles between 0 and 70 degrees. It has been observed that the shape of the angular dependency of surface erosion is strongly affected by the cluster size. For small and medium size clusters Ar_{366} and Ar_{872} the sputtering yield only slightly increases with the impact angle, has a broad maximum around 40 degrees, and decreases at larger angles. For large clusters, the yield strongly increases with the impact angle, has a maximum around 45 degrees, and steeply decreases at larger angles. It has been found that for all clusters the primary energy is deposited at the optimum depth. As a results, the sputtering efficiency only weekly benefits from shifting the energy profile closer to the surface observed at larger impact angles. This process is mainly responsible for a strong signal increase with the impact angle observed during atomic, and small cluster bombardment. At larger impact angle sputtering efficiency decreases due to increased effect of primary energy being backreflected into the vacuum. A strong increase of the sputtering yield with the impact angle observed for Ar_{2953} and Ar_{9000} clusters is attributed to the washing off mechanism stimulated in solid benzene by a flux of redirected Ar atoms. We believe that this mechanism is important for large cluster projectiles irradiating weakly bound solids.