Ion Beam Sputtering Yield Measurements by Quartz Crystal Microbalance

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Quartz-crystal microbalance (QCM) has been used as a sensitive device for the measurement of small mass changes for a long ago. In fact, using QCM we can measure the differential sputtering yield profile of a material, over a hemisphere above the target, very precisely. The sputtering yield depends on properties of both the incident ions (energy, mass, and incidence angle) and the target (mass, surface binding energy, surface topography, and even the crystal orientation). In our present study, we used a highly sensitive QCM to detect the mass change of the electrode material (gold and silver) through oscillations and calculated the corresponding sputtering yields. We used two types of ions, e.g, He and Ar, in an Ultra High Vacuum (UHV) chamber using the NTI ion gun as the ion source. Our experimental observation shows significantly higher sputtering yield values than that of the theoretically calculated ones, using SRIM simulations. In addition, we observed a significant reduction in the sputtering yield values with time, for a constant ion energy bombardment. Similarly, atomic force microscopy (AFM) study shows a significant reduction in the surface roughness values for a longer period of ion bombardment. These observations suggest that surface topography affects significantly the sputtering yield values. In the presentation the details of the disparities between experimental and the modeling will be discussed.