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Sputtering Processes Studied by Medium Energy Ion Scattering Spectroscopy

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Ion beam sputtering has been widely used for sputtering depth profiling with XPS and AES, as well as ion milling. However the problem of the surface compositional change and the structural damage due to ion bombardment has remained to be understood and solved. In this work, the altered surface and subsurface layers due to ion beam bombardment were depth profiled nondestructively and quantitatively with Medium Energy Ion Scattering Spectroscopy with the depth resolution of better than 1 nm.

Compositional changes of amorphous Ta_2O_5 thin films due to Ar^+ ion bombardment was depth profiled by MEIS as a function of the ion incidence angle, the ion energy, and the ion dose. MEIS could show the details of the depth profile of Ta that the oxygen depleted depth is 26Å under normal incident 3 keV Ar^+ ion bombardment and it decreases continuously with the incidence angle. Structural damages on Si(100) surface due to Ar^+ ion bombardment were also studied as a function of the ion dose and the incidence angle. The structural damage measurement was extended to the defect profile measurement for H_2 ECR etched Si(100) surfaces. The defect profiles measured by MEIS were compared with the TEM results. Some preliminary results on the compositional and structural profiling of GaAs(100) surfaces after ion bombardment will be also given to evaluate the preferential sputtering of Ga and As and the amorphization process. The above MEIS experimental results are compared with the computer simulations