

Spectrometer for Grazing Incidence XRF: Characterization of As Implants and Hf Layers

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Grazing Incidence X-ray Fluorescence Analysis (GIXRF) is a powerful technique for depth-profiling and characterization of thin layers in depths up to a few hundred nanometers. By measurement of fluorescence signals at various incidence angles GIXRF provides information on depth distribution and total dose of the elements in the layers. The technique is very sensitive even in depths of a few nanometers.

Therefore in the context of the EC funded European Integrated Activity of Excellence and Networking for Nano and Micro-Electronics Analysis (ANNA) GIXRF is used as a complementary technique to Secondary Ion Mass Spectrometry (SIMS) for the characterization of Ultra Shallow Junctions (USJ). SIMS is widely used for depth-profiling of implants in semiconductors, but is lacking accuracy in the first few nanometers of the substrate.

To meet the demands of GIXRF analysis a measuring chamber is currently under development by the X-ray group of the Atominstitut. The setup is equipped with an X-ray tube and a multilayer monochromatizing the exciting radiation. A Silicon Drift Detector (SDD) is used to allow the processing of high count rates due to the high fluorescence intensity of the substrate material above the critical angle. Sample and detector are placed in a vacuum chamber to eliminate the absorption of fluorescence radiation in air and simplify dose calculation. To allow exact positioning and variable angle steps, a sample stage with high-resolution linear actuators and a software package have been designed.

The design as well as the current status of the prototype will be presented. Furthermore results obtained in vacuum and air will be compared and discussed.