Refitting an X-ray Diffraction System for combined GIXRF and XRR measurements

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X-ray reflectometry (XRR) is a well-known and established technique for the characterization of single- and multi-layered thin film structures with layer thicknesses in the nanometer range. XRR spectra are acquired by varying the incident angle in the grazing incidence regime while measuring the intensity of the specular reflected x-ray beam. The shape of the resulting angle-dependent curve is correlated to changes of the electron density in the sample.

Grazing Incidence X-ray Fluorescence (GIXRF) is a Total Reflection X-Ray Fluorescence Analysis (TXRF) related technique, which uses the angle dependent XRF signal in the grazing incidence regime, i.e. in an angular range below and near the critical angle. The XRF signal is element-specific and therefore the measurements contain information about the elemental composition, concentration profile, thickness and density of near surface layers.

The combined measurement and evaluation of GIXRF and XRR data can improve the obtained information, as it reduces uncertainties and ambiguities of the individual techniques [1][2].

An Empyrean System, which is a commercial available platform for X-ray Diffraction applications, offers optics and detectors for XRR measurements. In order to allow for combined measurements, an Amptek SDD was added to this system and the acquisition of XRF spectra synchronized to the XRR scan.

A comparison of measurements, which were performed with different incident beam monochromators and mirrors, which are available for the Empyrean System, as well as a comparison to data obtained from a table-top spectrometer [3], which was specifically developed for combined GIXRF and XRR measurements, will be presented.