

Influence of the excitation energy on absorption effects in TXRF analysis

C. Horntrich¹, P. Kregsamer¹, S. Smolek¹, A. Maderitsch¹, P. Wobrauschek¹, R. Simon², A. Nutsch³, M. Knoerr⁴ and C. Streli¹

¹*Atominstytut, Vienna University of Technology, 1020 Wien, Austria*

²*Karlsruhe Institute of Technology (KIT), Institute for Synchrotron Radiation (ISS), Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany*

³*Fraunhofer Institute for Integrated Systems and Device Technology, 91058 Erlangen, Germany*

⁴*Fraunhofer Institute for Integrated Systems and Device Technology, 90443 Nürnberg, Germany*

Due to its outstanding properties Total Reflection X-ray Fluorescence Analysis (TXRF) is a well established analytical method in the semiconductor industry for the analysis of silicon wafer surfaces. One of the major problems for standardization of TXRF for wafer surface analysis is the large statistical uncertainty of quantification when using an external standard.

In general TXRF is known to allow for linear calibration. For small sample amounts the thin film approximation can be applied and hence absorption effects of the exciting and the detected radiation can be neglected. For higher total amounts of sample deviations from the linear relation between fluorescence intensity and sample amount have been observed (saturation effect). These lead to difficulties in quantification with external standard.

Content of the presented work is an investigation of the absorption phenomenon and hence the fluorescence intensity to improve the statistical quality of TXRF quantification.

Samples with different total amounts of nickel were prepared and the emitted fluorescence intensities were measured at two different excitation energies to estimate the upper limit of sample mass where the relation between fluorescence intensity and sample amount diverges from linearity depending on the excitation energy. The measurement results were compared to calculations performed with a self-developed simulation model. It was found that if the excitation energy is closer to the absorption edge of the excited element (which means better excitation) the saturation effect appears at a lower sample mass.