IMPROVEMENT OF CALIBRATION PROCESSES IN TXRF OF WAFER SURFACE ANALYSIS: INVESTIGATION OF SATURATION EFFECTS IN TXRF BY COMPARING DIFFERENT SAMPLE SHAPES

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One of the major problems for standardization of TXRF for wafer surface analysis is the large statistical uncertainty of quantification. The presented work intends to improve the statistical quality of TXRF quantification by investigating the influence of the sample shape on absorption effects and hence the fluorescence intensity.
In TXRF, absorption effects concerning the exciting and the detected radiation are usually disregarded. This is justified because mostly small sample amounts are used and the thin film approximation can be applied. For higher total amounts of samples, deviations from the linear relation between fluorescence intensity and sample amount have been observed (saturation effect). These lead to difficulties in external standard quantification.
The topic of the presented work is an investigation of the saturation effect by comparing the fluorescence intensities emitted by samples with different shapes. The element nickel (Ni) was chosen for these investigations because it is usually used as reference standard for calibration of TXRF Wafer analyzers in the semiconductor industry.
Firstly the fluorescence intensity emitted by theoretical sample shapes was calculated for two different excitation energies and it was investigated which sample shape leads to the highest fluorescence intensity and exhibits the lowest saturation effects. The calculations were performed with a self-developed simulation model. It could be shown that spherical segments lead to the best results but the optimum diameter/height ratio is depending on the exciting energy.
Secondly the influence of different sample preparation techniques on the resulting TXRF sample was investigated with aim to find a possibility for a rather simple production of the ideal TXRF sample. It could be shown that the sample contraction is dependent on the pipetted volume – the smaller the pipetted volume and hence the higher the concentration, the smaller the diameter of the sample.