Determination and production of the ideal TXRF sample

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Total Reflection X-ray Fluorescence analysis (TXRF) is widely used in semiconductor industry for the analysis of silicon wafer surfaces. Typically an external standard is used for the calibration of the spectrometer. This is sensitive to errors in quantification. For small sample amounts the thin film approximation is valid, absorption effects of the exciting and the detected radiation are neglected and the relation between sample amount and fluorescence intensity is linear. For higher total sample amounts deviations from linearity have been observed (saturation effect). These deviations are one of the difficulties for external standard quantification.

Content of the presented work is the determination and production of the ideal TXRF sample to improve external standard quantification. 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.

A comparison of theoretical samples with different shapes, by model calculations, shows that the ring shape matches the ideal TXRF sample shape best and exhibits the lowest saturation effect.

After theoretically determining the ideal TXRF sample it was investigated if there is a simple method for the realization of a ring shaped sample. A possibility for the production of samples with a well defined morphology in a ring shape is to use picoliter droplet depositions. Therewith it is possible to produce ring shaped samples in a controlled way with the ring consisting of individual picodroplets, so that the wanted diameter of the ring can be chosen. Here a Sonoplot pipette was chosen; because the software allows for easily generate the ring shape pattern. A comparison of the fluorescence intensities emitted by contracted and ring shaped samples will be presented.