# Si Wafer Analysis of Light Elements by TXRF – Chamber Adaption to Fit 6“ and 8“ Wafers

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TXRF is a well-accepted method to determine surface contamination on Si wafer surfaces. The ATI X-ray Lab offers suitable equipment to measure light elements (Z<14) under vacuum conditions (mbar range from a membrane pump). The measurement set-up consisted of a modified vacuum chamber suitable to accommodate 6”- 8” wafers on a rotatable sample carrier. As the source serves a 1.9 kW Cr anode X-ray tube (long fine focus) with a multilayer monochromator and an adjustable slit-system and a SiLi detector (Oxford Premiumgrade B35; 30 mm² and 133 eV @ 5.9keV energy resolution) with an ultra thin window (AP3 Ultra-thin Polymer X-ray Window) equipped with an electron trap (∅ 6mm, two REE high field magnets) to suppress noise originating from Auger electrons, which collect the photons.

The chamber was reconstructed to accommodate 6” (150mm) and 8” (200mm; size limit) wafers to meet the demands of semiconductor industry. Due to the limited space in the chamber, special sample carriers were designed to avoid contamination of the sample when placing it onto the carrier. The insertion of the 8” wafer requires a special tilting mechanism to avoid any contact of the sample with the chamber walls and other components. The chamber size does not allow any movement of the 8” wafer; therefore samples of this size can only be analyzed at the center position. The 6” wafer carrier is rotatable and therefore a wider range of surface points within a radius of 65mm can be reached. A remote controlled UHV stepper motor achieves the rotation. Angle scans can be performed under controlled conditions to achieve angle dependant measurements to determine the critical angle and/or differentiate between bulk, layer and particle type samples. This feature furthermore allows adjusting and reproducing the measurement angle with high precision, which is important for a quantification using an external standard.

Investigations of the different absorption effects on the fluorescence radiation of light elements were done. Droplets containing Mg and two types of elemental matrices consisting of a) medium Z elements (Ti-Zn) and b) light elements (Na, Mg, Al) were prepared on 6” Si wafers in the laboratory of Siltronic AG in Freiburg. For the low Z elements concentrations of 10ng, 100ng, and 1000ng were taken and for the medium Z elements a variable concentration range from 1ng to 100ng was chosen.

It was assumed that the presence of medium Z elements causes a stronger absorption of the light elements’ fluorescence, whereas light elements affect each other non-serious.