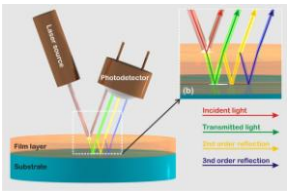
ThetaMetrisis APPLICATION NOTE #003

Thickness measurement of Thin and Ultra Thin films by White Light Reflectance Spectroscopy (WLRS)



Goal: The accurate measurement of the thickness of thin and ultra thin metallic and dielectric single films down to the sub-10nm range.

Means & Methods: WLRS is introduced for the measurement of film thicknesses in the case of single dielectric and metallic films with thickness in the sub-10nm range. The measurements were performed by an FR-Basic UV/NIR equipped with a UV-NIR (200-950nm) spectrometer and a deuterium-halogen/tungsten light source. The substrate is Si wafer.

Results: In figs. 1 and 2 the experimental and fitted with WLRS spectra of two thermal SiO_2 layers on Si wafer are depicted. The calculated thicknesses, 8.7nm and 5.7nm respectively, are in very good agreement (<0.5nm difference) with independent measurements performed with spectroscopic ellipsometry.

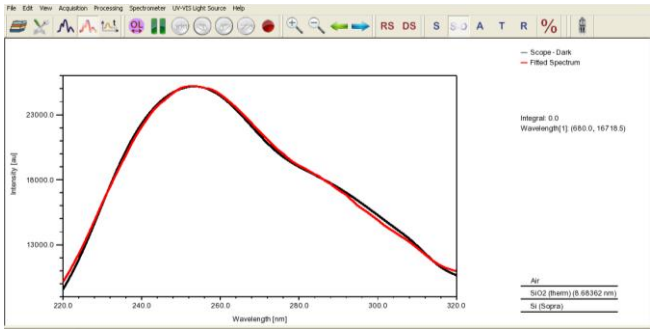


Figure 1: 8.7nm thermal SiO_2 on Si wafer.
Black line: Reflectance spectrum, Red line: Fitted spectrum

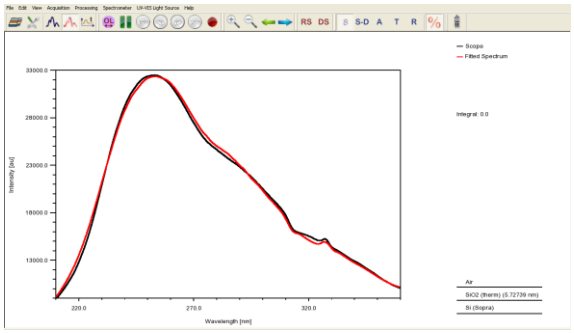


Figure 2: 5.7nm thermal SiO_2 on Si wafer.
Black line: Reflectance spectrum, Red line: Fitted spectrum.

In fig. 3, the experimental and fitted spectra for a 14.2nm Au film deposited by sputtering on Si are shown. In fig. 4 an ultra thin Au layer was deposited on a thermally oxidized Si wafer. The existence of the interference fringes due to the thick SiO_2 layer allows for the accurate measurement of ultra thin Au layers (2.5nm).

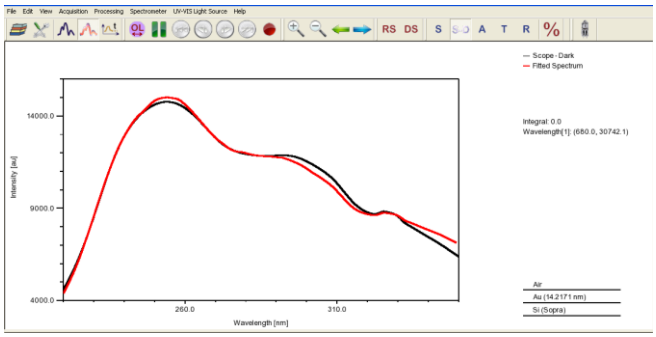


Figure 3: 14.2nm Au film (by sputtering) on Si wafer.
Black line: Reflectance spectrum, Red line: Fitted spectrum

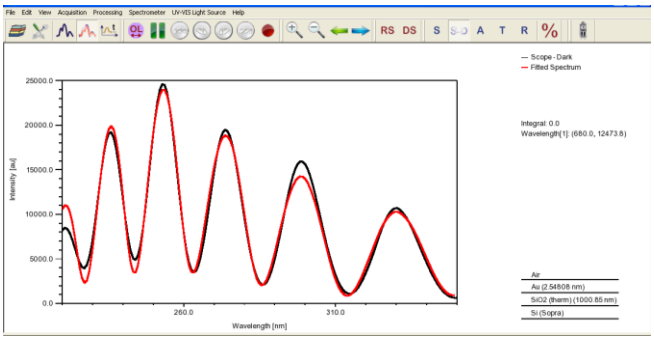


Figure 4: 2.5nm Au film on 1000nm SiO_2/ Si wafer.
Black line: Reflectance spectrum, Red line: Fitted spectrum

Conclusions: Thus WLRS methodology, in UV spectral range, allows for the thickness measurement of single dielectric and metallic films down to 5nm. Furthermore the use of an intermediate dielectric layer allows for the thickness measurement of ultra thin metallic films, down to 2.5nm.

For further information please contact us at info@thetametrisis.com or sales@thetametrisis.com