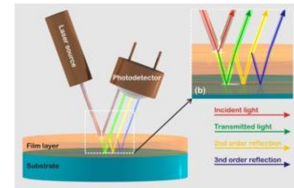
θmetrisis Film Metrology Specialists

ThetaMetrisis APPLICATION NOTE #015

Thickness uniformity measurement of Thick films by White Light Reflectance Spectroscopy (WLRS)



Goal: The accurate measurement of thickness and its uniformity of thick films on a reflective substrate.

Means & Methods: WLRS is introduced for the measurement of film thickness and uniformity in the case of thick transparent films. All measurements were performed with an FR-Basic tuned to operate in the 400-1000nm spectral regime. The samples were Si wafers coated with thermal SiO_2 and SU-8 films via spin coating. For the reference measurements a standard Si wafer was used.

Results: Film thickness uniformity depends strongly on the film application method. Spin coating of viscous solutions at low speed could produce film thickness non-uniformity while processes such as thermal oxidation or CVD lead to uniform films. In figs. 1-2 the film thickness measurements of a 3.0μm thick SiO_2 are illustrated. Due to the thermal oxidation process the non-uniformity is zero (fig. 2). In figs. 3-6 the film thickness measurements of thick spin-coated SU-8 films are presented. In the case of 10μm SU-8, the non-uniformity over the probed area (~350μm diameter) is 12nm (fig. 4), considerably lower from the value for the 50μm SU-8 film, 131nm (fig. 6), because of the use of lower viscosity solution and application at higher speed.

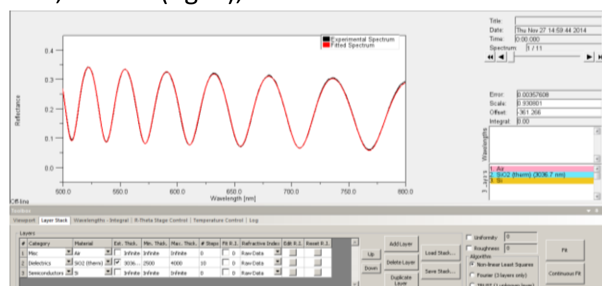


Figure 1: Experimental and Fitted reflectance spectra from ~3 μm SiO_2 film without uniformity. Black: experimental, Red: fit.

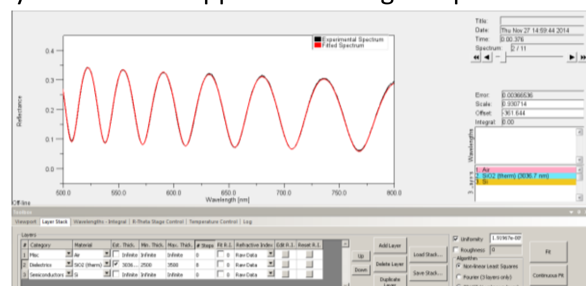


Figure 2: Experimental and Fitted reflectance spectra from a ~3μm SiO_2 film. Zero non-uniformity is calculated.

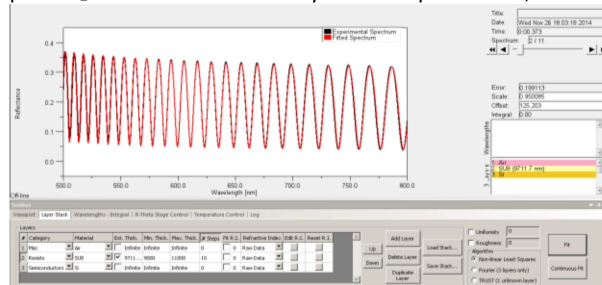


Figure 3: Experimental and Fitted reflectance spectra from a ~10 μm SU-8 film without non-uniformity.

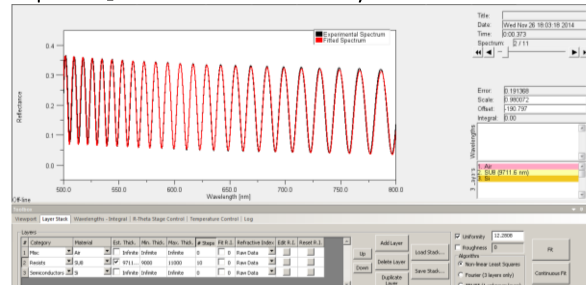


Figure 4: Experimental and Fitted reflectance spectra from a ~10 μm SU-8 film with non-uniformity.

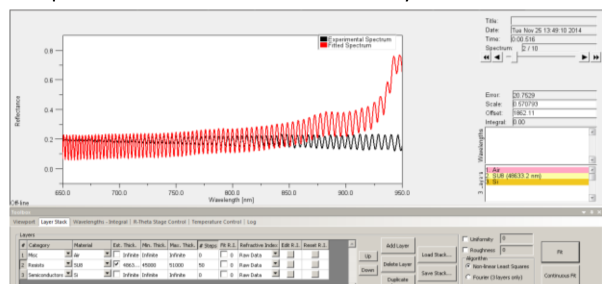


Figure 5. Experimental and Fitted reflectance spectra from the ~50 μm SU-8 film assuming zero non-uniformity.

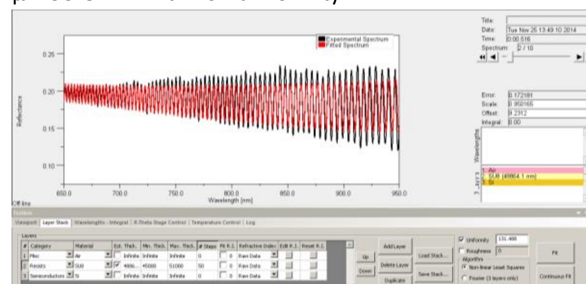


Figure 6. Experimental and Fitted reflectance spectra from the ~50μm SU-8 film. Non-uniformity is calculated with accuracy.

Conclusions: The accurate measurement of film thickness and film thickness uniformity was demonstrated.

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