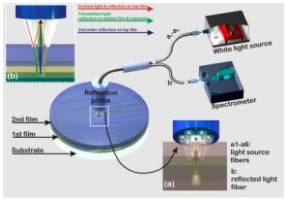
ThetaMetrisis APPLICATION NOTE #001

Characterization of Si membranes
Using White Light Reflectance Spectroscopy (WLRS)



Goal: The characterization of thin Si membranes.

Means & Methods: Samples were suspended Si membranes on Si wafers with intermediate layers of SiO_2. Si absorbs in the visible range of the spectrum and for thick membranes measurements should be performed in the NIR range. The measurements performed with an FR-Basic IR operating in the 900-1700nm spectral range. The reflection probe used in the present evaluation has an optical reflectance diameter of ~500X500μm^2.

Results: In fig. 1, a representative reflectance spectrum for the 900-1700nm range from a Si membrane is illustrated. The membrane area is 300X900μm^2. The stack considered in this case was Air/Si(100)/SiO_2/Air i.e. a suspended Si membrane on an ultra thin SiO_2 layer, fabricated with back-side etching of the supporting Si wafer. In fig. 2 a blow-up in the spectral region (930-1200 nm) used for the fitting is shown. The calculated film Si membrane thickness is 5.25μm.

Figure 1: Typical reflectance spectrum for a suspended Si(100) membrane on an ultra thin SiO_2 layer.

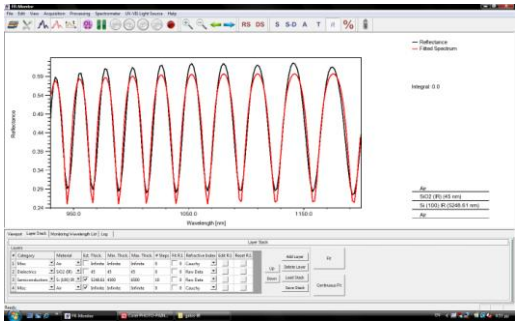


Figure 2: Experimental and fitted reflectance spectra for fig's 1 data.

In fig. 3 the experimental and fitted reflectance spectrum from a SOI wafer are shown. The cavity is 300X900μm^2. The calculated thicknesses for the Si over layer and the SiO_2 layer are 5.04μm and 0.48μm respectively.

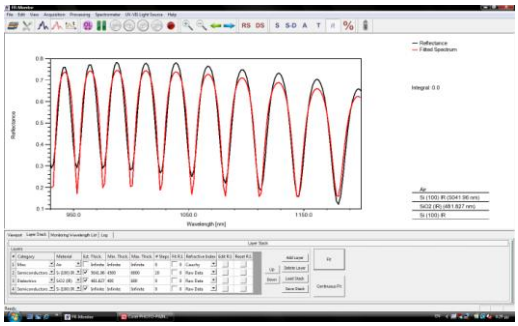


Figure 3: Reflectance and fitted spectrum from a SOI wafer.

Conclusions

WLRS methodology is capable of measuring the film thickness of Si membranes over a wide thickness range starting from few tens of nm up to several microns (depending on the Fr-Basic configuration).

KOH etching produces surface etching that is too high for the WLRS methodology. In case of back-etch or front-etch Si cavities/membranes double-sided wafers should be used.