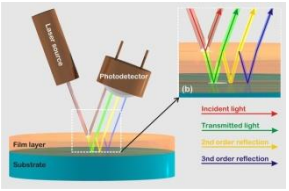
ThetaMetrisis APPLICATION NOTE #040

Thickness and Refractive Index calculation of Oxynitride layer



Introduction:

Silicon Oxynitride is an inorganic material which possesses high durability at high temperature, high resistance to thermal-shock and oxidation, high density, excellent mechanical performance, and excellent photoelectric performance. These characteristics makes it a very attractive material for a variety of applications. In addition, its dielectric constant can be tuned by adjusting the relative concentration of oxygen and nitrogen, making it as ideal material for photonic applications (waveguides). In this application note, a **ThetaMetrisis FR-pRo** tool is used for the characterization of a Silicon Oxynitride layer in terms of thickness and refractive index.

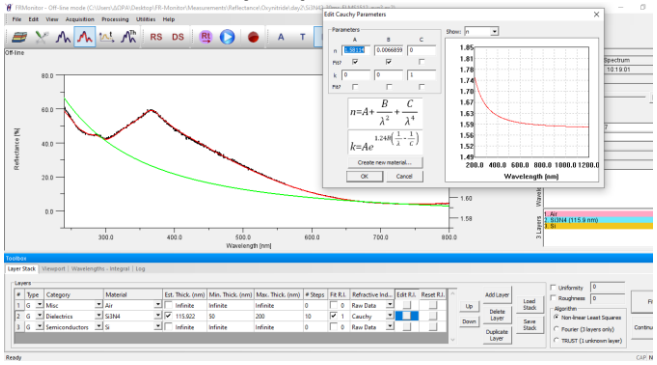
Means & Methods:

The layer stack under investigation was a Silicon oxynitride layer on top of Si substrate deposited by Chemical Vapour Deposition (CVD). Two different dispersion models (Cauchy and Lorentz) were employed in order to determine the refractive index and the thickness of the layer. Measurements were carried out with an **FR-pRo UV/VIS** operating at the 200-850 nm spectral range.

Results:

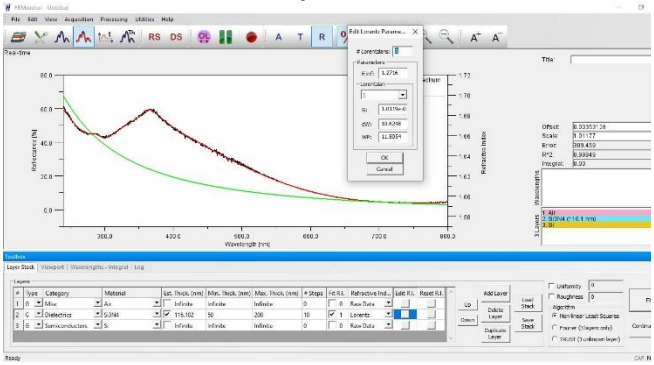
Typical experimental reflectance spectra (black line) and fitted reflectance spectra (red line), as recorded by the FR-Monitor software, and the calculated refractive index (green line) of the Silicon Oxynitride layer, are illustrated in the figures below. Fitting was applied in 240-800nm spectral range. With Cauchy Dispersion Model thickness and refractive index (at 600nm) calculated at 115.92nm and 1.5997 respectively, while in case of Lorentz Dispersion Model thickness and refractive index (at 600nm) calculated at 116.10nm and 1.5983 respectively. These results show that the concentration of nitrogen in the particular film was low, since the refractive index is very close to the one of pure SiO_2.

Cauchy Dispersion Model



Thickness (nm)	Refractive Index (@600nm)
115.92	1.600

Lorentz Dispersion Model



Thickness (nm)	Refractive Index (@600nm)
116.10	1.598

Conclusions: FR-pRo UV/VIS tool was successfully used for the Thickness and Refractive Index calculation using Cauchy and Lorentz Dispersion Models.