Infra Red Spectroscopic Ellipsometry for semiconductor applications : A new metrology tool for 300 silicon wafer technology

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Spectroscopic Ellipsometry (SE) is commonly used to characterize thin layers in the UV - Visible spectral range. In the Infra Red (IR) region, several materials become transparent like the silicon and other new information can be extracted. Molecular absorption bonds can be detected and are generally representative of the layer composition and contamination (the example of a low k SiOCH composite films is reported in Fig. 1). The active dopants change the absorption in the infrared range due to the Drude tale and so, concentration and depth profile of dopants can be measured in a non destructive way (cf. Fig. 2). Thickness is also deduced and spread sheet resistance can be deduced. Measurement on structural features like deep trenches smaller than the wavelength can be useful to deduce structural parameters of deep trenches, STI and vias.

A new infrared spectroscopic ellipsometer devoted to the characterization of silicon microelectronics has been developed recently at Sopra. Its main feature are the ability to measure on a small spot (80x200µm) with a high signal/noise ratio. Good quality spectral measurements in the 600-7000cm-1 range are then performed in less than 30s. The back face reflection is suppress directly by the original optical design. All automation and real time analysis are included to offer a operated orientated metrology tool.

In the proposed paper, the instrument will be presented in details, as well as the performances. Different applications will be also discussed.

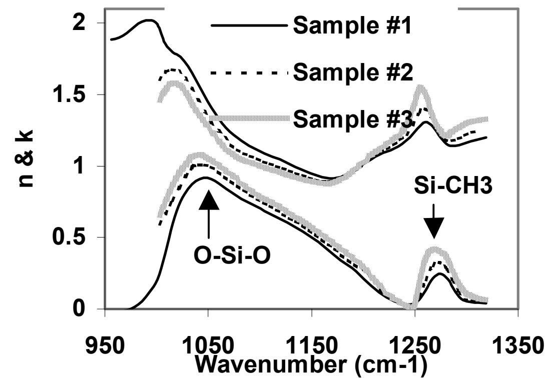

Fig. 1 : Measured optical indices of different Si-O-C-H films using IRSE system. The thickness of the films is between 300 and 500nm

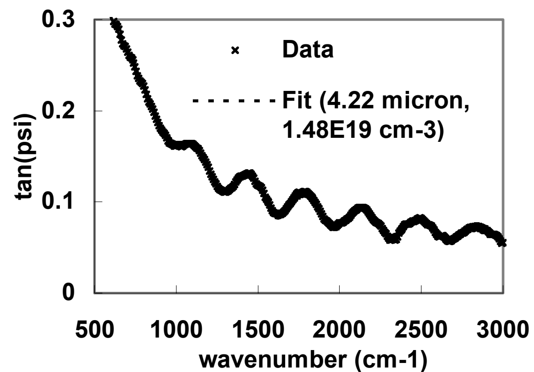

Fig. 2 : Measured and fitted tan Ψ spectra of p-doped Si epilayer.