Advanced metrologies for topography and thickness measurements

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ABSTRACT

Atomic force microscopy (AFM) is in common use in the semiconductor industry for surface geometry characterization. Despite the wide range of applications addressed by AFM, the technique is speed limited and contacts the surface. Because the probe contact with the surface may be destructive and the long time required for measurements, most AFM users limit the surface characterization to a few measurement locations.

Optical profilometry typically uses the interference between coherent light scattered from the test surface and from a reference surface to produce fringes. Of particular interest, the Scanning White Light Interferometry (SWLI) [1,2] combines the strengths of both Phase Shift Interferometry (PSI) and Vertical Scanning Interferometry (VSI) modes since the fringe coherence peak and the phase are used for the raw data processing. Similar to AFM images, the height map allows defect identification of features on a surface. However, conventional optical profilometry, contrary to the AFM, is limited to measurement of substrates or opaque surfaces.

A new data processing approach, proposed by ZYGO/Nanometrics, further expands the technique by analysis of the collected interferograms (ICT: Index Corrected Topography) to extract films parameters (thickness, for instance) and surface topography. This model based technique delivers literally complete information (*e.g.* topography, roughness, filmstack properties) of measured structure with sub-micron lateral resolution and angstrom vertical resolution. The approach is a strong asset since it allows contact less topography measurement of wafer surfaces in the low spatial wavelength range (i.e.: 0.599 – 5 µm).

In this paper we will show how this specific metrology can meet the aforementioned stringent requirements. The measurement stability and its accuracy will be discussed, and comparison with both the AFM and the spectroscopic ellipsometry will be presented.

REFERENCES

1. X. Colonna de Lega and Peter J. de Groot, *Proc. of SPIE* Vol. 6995 69950P-1.
2. Peter de Groot and Leslie Deck, Proc. SPIE 2248; pp. 101-104 (1994)