Micro roughness determination of periodic microelectronics structures using optical far field measurements

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ABSTRACT

Recently, a novel approach was proposed for the determination of micro roughness on periodic structures through optical far field characterization using an angle resolved scatterometry set up developed at Fresnel Institute [1]. The light source used in our experiment is a He-Ne Laser using a wavelength of 632.8 nm. The incidence angle equals to 0° and the measurements are performed in the incident plane at a scattering angle ranging from 10° to 90°. A somehow similar approach but at a single 90° collection angle has been reported recently [2].

The scattered intensity is the sum of that of a periodic structure and that of a rough surface. The exact numerical model allows treating the periodic part of the structure while the roughness is viewed as a perturbation and treated using a first order approximation.. Scattering intensity is extracted and is calculated in each direction of space. Theoretical simulation performed using a computer code developed at Fresnel Institute based on differential method [3] and results derived from measurement performed with the aforementioned optical set-up demonstrated the validity of the approach.

The weak point of our present set up is the relatively large size of the illumination beam limiting its use on large structures of test vehicles rather than scribe lines structures. Modification of the optical set-up to reduce the beam spot size is underway. We will describe the optical principle and the theoretical approach for data treatment and to show roughness data in good correlations with AFM values extracted from common part of power spectrums.

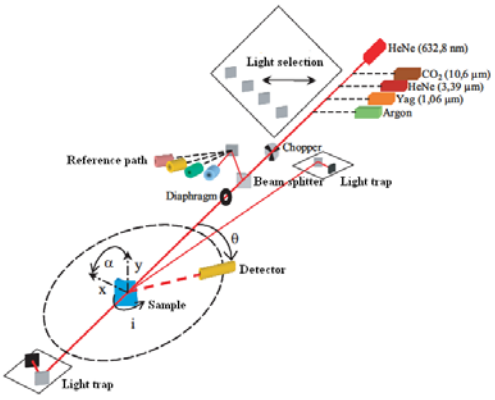

Figure 1: Optical set up

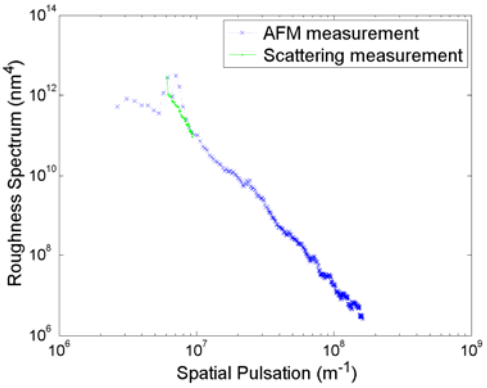

Figure 2: Roughness spectrum of grating: Optical versus AFM

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Key words : scattering, roughness, far field, AFM