Development of the scattering microscope by coherent EUV light

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In the fine pattern observation less than 32 nm hp by an optical microscope system, a resolution is limited by a numerical aperture size and a wavelength. A new system of a CD measurement is needed for 22 nm hp and further 15 nm hp.

The outline of a coherent scattering microscope developed is shown in Fig. 1.The light from coherent EUV light is irradiated at a sample, and the reflective diffraction pattern is obtained by a CCD camera and the reverse Fourier transform is carried out with a computing system to reproduce a sample image.

CD measurements in an area of 100 mm x 100 mm evaluated by the EUV coherent scatterting microscope (CSM) and the comparative evaluation in CD-SEM measured are shown in Fig.2.

Evaluation of CD values were represented as a counter displayed. The tendency for CD values of two methods showed good coincidence, so that it went to the center from the outside.

Moreover, the measurement results of CD values by CD-SEM shown in Fig.2(a) represented as a smaller value to the target value of 136 nm.

On the other hand, in CSM of (b), it became a value near a designed value like 140 nm.

Moreover, both CD variation in the whole 6 inch is almost 4.5 nm in 3sigma value, and the measurement reliability in the CSM method was acquired.

Here, since the measurement system in CD-SEM has detected secondary electronic signals in the upper part of an absorber pattern, the measured value of CD-SEM of (a) appeared small, when the side wall of an absorber pattern serves as inclination form.

On the other hand, the value of CSM of (b) shows the pattern size in a multilayer film reflective surface.

Since the degree of incidence angle to the mask in CSM is equivalent to the incidence angle of an actual exposure machine, it is measured as a CD value at the time of the more nearly actual exposure including the influence of the shadowing effect in an absorber portion, and measurement of realistic size evaluation data is possible for it.

The newly develpoed imaging technique at EUV wavelength regime has a better reliability in the critical dimension (CD) measurements and lower cost of ownership than conventional EUV imaging system using the schwarzschild optics or x ray zone plate as imaging optics.

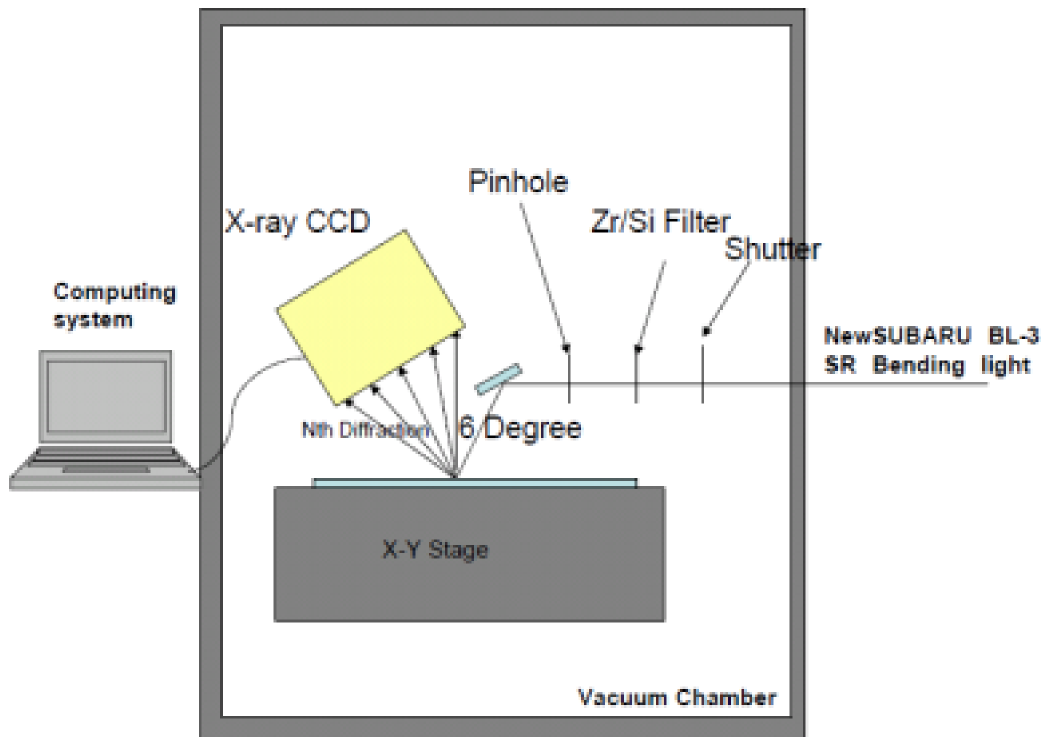
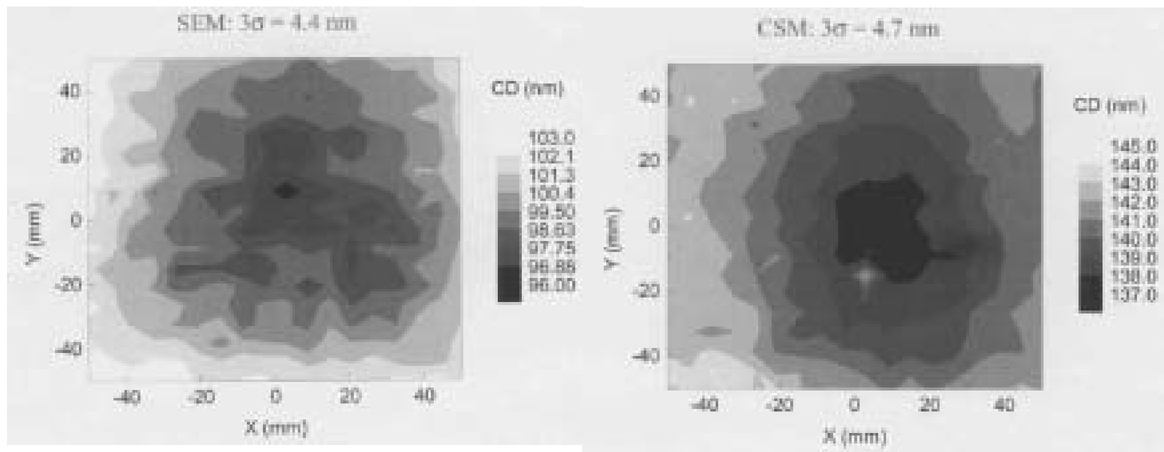


Figure 1. Configuration of Coherent Scattrometry Microscope



(a) CD-SEM

(b) CSM

Figure 2. Comparison measurements of Critical Dimension of 32 nm hp mask