Application of Metrological Scanning Electron Microscopy in micron and nanometer structure measurement

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Abstracts. Micro-structure dimension metrology is a grand challenge to current metrological methods and tools.[1] Especially, for international technology roadmap for semiconductor, metrology is an important part of integrated circuits manufacturing system.[2] Semiconductor device feature size has shrunk from the micron to dozen of nanometers.[3] How to watch the micro structure clearly, identify its edge, and measure its dimension accurately are the major issues that need to be research.[4] In this paper, a retraceable metrological scanning electron microscopy (M-SEM) system with precision stage and laser interferometer is presented in detail. Furthermore, this paper focuses on demonstrating a metrological SEM image edge detection algorithm which is the essential part of the metrological SEM system to realize the measurement of line width.[5] This algorithm preserves the edge details of the original image and detects the image edge automatically in an easy and fast way.[6-7] Finally, the measuring accuracy is discussed in several aspects: image resolution, e-beam floating, mechanical assembling error, x-y axis orthogonality error, etc.

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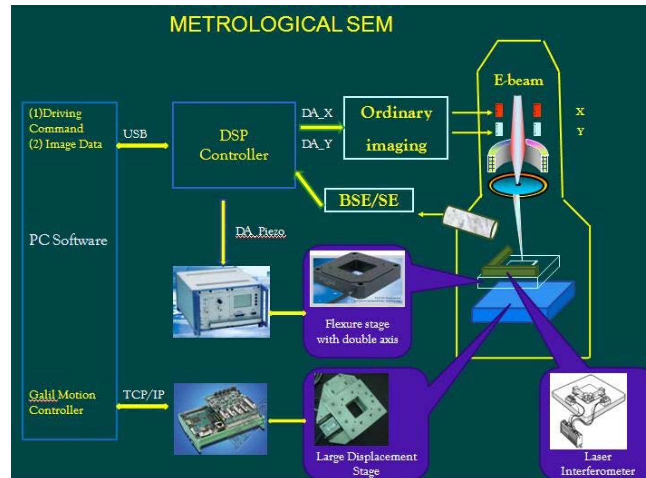


Fig.1 System structure of metrological SEM

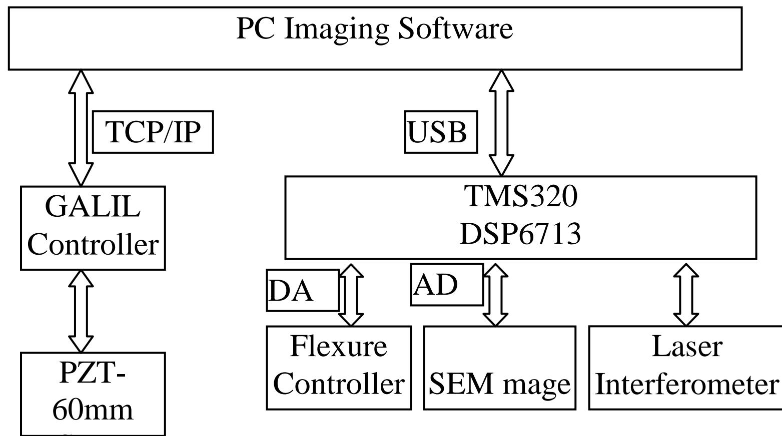


Fig.2 Control system diagram for metrological SEM

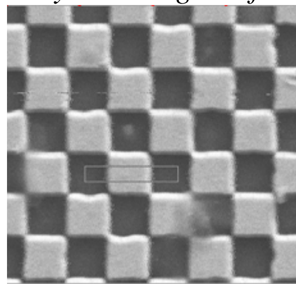
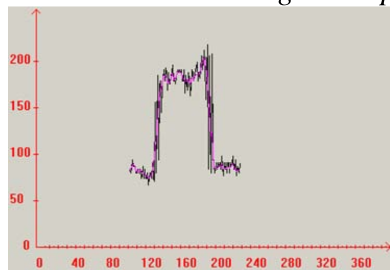


Fig.3 Sampling area in SEM image



(a) Acquiring original edge data

(b) Final Edge Data

Fig.4 Metrological SEM image edge detection algorithm