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The scanned-probe microscope as nano-metrology tool[1] YING XU, K. MOLONI, M.G. LAGALLY, nPoint, Inc., Madison WI 53714 www.npoint.com — Metrology is an essential requirement in the microelectronics industry. As features in computing and memory devices (and also in the flat-panel, hard disc, and CD/DVD industries) reach farther into the nanoscale, their metrology becomes increasingly difficult. Scanned–probe microscopes (SPMs) offer potential solutions. SPMs can produce images with resolution down to the atomic level. However, because of inherent nonlinearities, conventional SPMs possess poor metrology capabilities. Nanometrology requires closed-loop scanning, high throughput, and long-term stability, with subnanometer lateral and vertical resolution and extreme scan flatness over 100s of μm. We have developed metrology scanners suited for high-precision scanning and positioning applications. They have ultralow out-of-plane motion error (<1 nm over 100 μm scan area). A DSP-based controller enhances the scanner performance. Advanced control algorithms improve dynamic characteristics of the system significantly by reducing phase lag and settling time. The motion control system routinely achieves sub-nanometer resolution and accuracy with high working bandwidth and long-term stability. Using the performance of these metrology scanners we propose a vision of a complete SPM-based CD metrology tool that will enable nanometrology of future generations of electronic devices.

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