PRODUCT DATA

FEI COMPANY™

SNP™ XT

Stylus Nanoprofilometry for Automated, 3D Mask Metrology and Defect Inspection at 90 nm Technology and Beyond

- *Delivers precision metrology for characterization and verification of mask repair for the 90 nm technology node and beyond.*
- *Delivers non-destructive, accurate, quantitative 3D shape measurements on advanced photomasks without influence from surface charging effects.*
- *Combines with FEI's Accura™ focused ion beam (FIB) mask repair series for a total mask repair solution.*
- *Produces complete metrology series: critical dimension, Z height, sidewall angle, and surface roughness on all types of advanced mask designs.*
- *Recipe wizard allows operators to automatically collect 3D contour mapping scan of select defects from imported files.*
- *Speeds your time to data with automated sample handling and metrology routines.*

Building a production photomask set is an exacting process. Engineers face new challenges when characterizing mask features and verifying that they meet design specifications. Because optical line width measurement tools are now reaching their limits of feature size resolution, and CD-SEMs are unable to provide depth measurements, these engineers are now relying on an advanced new tool for three dimensional metrology: the SNP XT.

FEI's SNP XT Stylus Nanoprofilometer™ delivers true, 3D contour maps, providing the most accurate characterization of mask features or repair integrity. The SNP collects critical dimension measurements of Z height, sidewall angle, and surface roughness on all types of advanced mask designs, delivering the detail required to verify design rules. It also offers the ability to measure repair parameters such as edge placement repeatability, clear repair patch thickness, opaque repair riverbed depth, and critical dimensions of isolated, dense, and geometry copy repairs.

The SNP XT utilizes a modified Scanning Probe Microscopy (SPM) technique designed to deliver the most precise metrology with immunity from the surface charging effects that are inherent with other AFM tools. With surface charging eliminated, the SNP is able to provide the most accurate measure of surface height.

Automated data collection routines can be defined to speed the process of measurement acquisition and data analysis. Users can write recipes that direct the SNP XT to navigate to specific areas on the mask, collect metrology, and produce reports. Robotic sample handling further speeds time to data.

The SNP XT has been developed in close partnership wtih leading mask manufacturers to ensure that it meets mask characterization and metrology needs of the 90 nm node and beyond.

Phase Shift Mask Characterization

Phase shift masks require precise Z-height metrology as the phase shifting properties are dependent on Angstrom-level changes in etch depth. CD SEMs and optical metrology tools, while offering high throughput, cannot obtain depth measurements. Only the SNP XT can deliver the precise 3D metrology performance that advanced mask makers demand.

Photomask Repair Applications

The SNP XT teams with FEI's Accura FIB mask repair tool to provide the only metrology and repair solution that increases mask yields to the next level. The SNP is used pre-repair, delivering topographical defect data required to optimize the repair. The SNP also is used post-repair to verify that the defect has been accurately removed.

Clear and Opaque Defect Repair

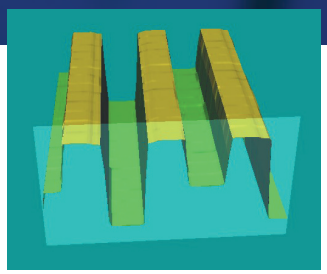
Clear and opaque defect repair verification requires accurate measurement of edge placement and riverbed depth and profile. The SNP is able to profile and deliver metrology results that quantify whether proper amounts of opaque carbon film have been deposited or that proper amounts of absorber have been removed.

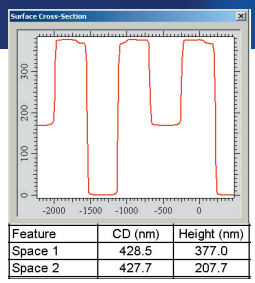
Quartz Bump Repair

Quartz bump repair poses a high degree of difficulty because the bump and surrounding material are both quartz. Typical endpointing strategies don't work because the signal would be the same from each similar material, regardless of topography. The SNP is able to generate a contour map of this same defect, including exact measurement information. This map is exported to the FIB and translated into a dose profile that defines the exact FIB system parameters needed to precisely remove the defect without over or under etching. A post-FIB inspection of the repair with the SNP verifies the successful removal of the defect.

Complete Life Cycle Support

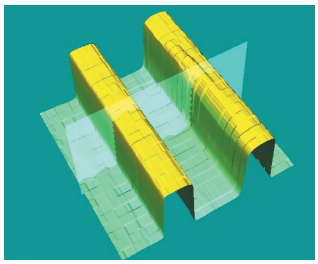
Your investment in the SNP XT is fully supported by the industry leader in Structural Process Management™. Our global network of applications experts and service personnel is ready to assist, and we are continually working to add value to your purchase through an aggressive program of product enhancements, software upgrades, and training—all to ensure that your SNP XT system will support your process management needs for years to come.

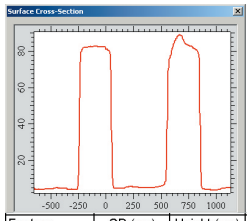




Feature	CD (nm)	Height (nm)
Space 1	428.5	377.0
Space 2	427.7	207.7

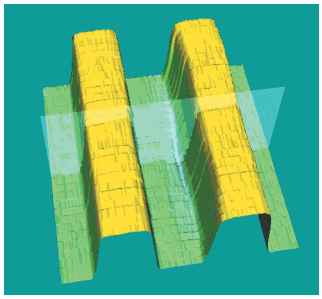
Alternating aperture phase shift mask metrology. SNP metrology delivers < 2nm 3σ CD precision and < 0.25nm 3σ Z-height precision.

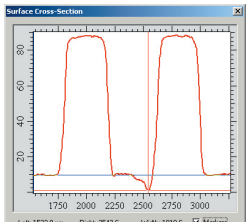




Feature	CD (nm)	Height (nm)
Control Line	283.8	77.8
Repair Line	287.1	83.0

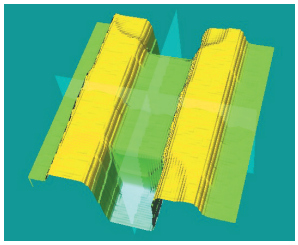
SNP XT 3D image of clear repair with metrology cross section comparing control line with repaired line.

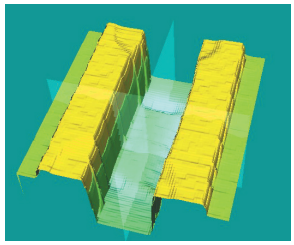




Feature	CD (nm)	Height (nm)
Control Line	397.4	78.1
Repair Line	383.5	86.5

SNP XT 3D image of opaque repair with metrology cross section comparing control line with repaired line.





Left: SNP XT 3D image of quartz bridging defect before repair. Right: SNP XT 3D image of quartz bridging defect after repair by Accura mask repair tool.

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