Device Optimization by Smart Nanopatterning Strategies Using Focussed Electrons and Ions

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Multi-technique electron beam lithography (EBL) systems or other nanofabrication instrumentation comprising both an electron and an ion beam optics (SEM/FIB tools) have proven to be flexible multi-purpose tools covering a broad range of nanotechnology applications. They are regarded as a "must have" in today's research and development based laboratories of various disciplines. These techniques routinely provide nanopatterning resolution with sub 10nm feature sizes and are well suited for nano-research - excellent beam control provided.
In order to secure stable, reproducible, highest precise and efficient operation for optimum results and device performance, advanced patterning control and strategies for these tools come into play. Only by exploiting innovative, dedicated nanofabrication hardware and software architecture, their true nanopatterning potential can be fully unlocked.
In this talk, we will focus on the optimization of three application classes/categories, which are typical and representative for a large group of nanofabrication tasks:
(1) Eliminating stitching errors in extended patterns exceeding typical write field sizes by far.
As an example, we present high performance waveguides and large area gratings that are fabricated using unique "continuous writing modes"
(2) Securing maximum pattern placement accuracy and optimum shape definition during long term ion beam induced nanofabrication processes.
For nanofabrication of a "perfect" photonic crystal, excellent drift compensation control, material redeposition avoidance and application specific directional nanopatterning modes have been applied.
(3) Nanofabrication of 3D-deposits and freely suspended nano-devices.
Exploiting "patterning on image" algorithms and specific directional scanning/nanopatterning modes ("FLEXposure") can be very helpful for straightforward and successful fabrication of true nano-electro-mechanical devices.

Figures

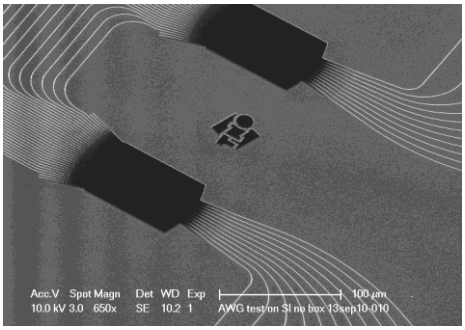

Figure 1: Arrayed Waveguide Grating (AWG) with couplers using "continuous writing modes"

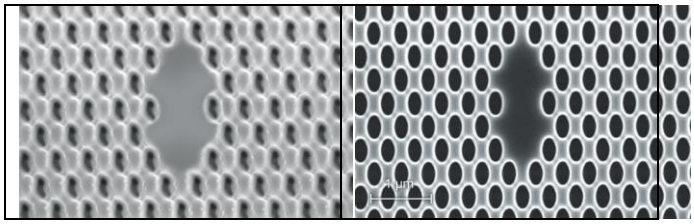

Figure 2: Photonic crystal milled without and with optimized patterning strategy

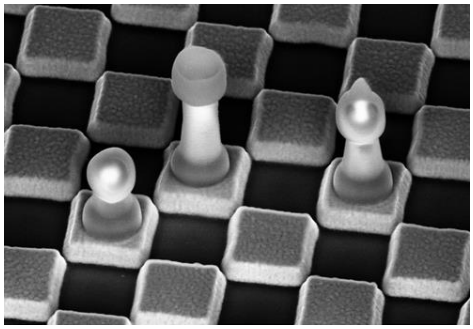

Figure 3: 3D deposit using specific directional scanning/nanopatterning modes