

New progressive method suitable for the exposure optimization of large and complex defect-free chips direct written by ZBA 21 e-beam tool

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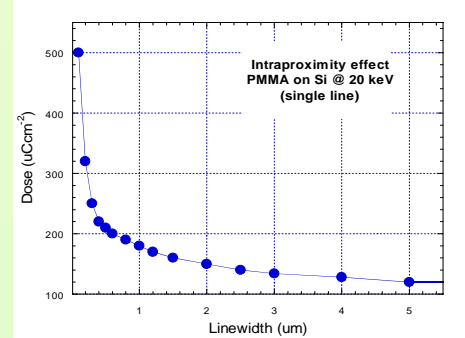


Abstract :

The use of a new progressive method suitable for the exposure optimization is investigated for large and complex defect-free chips direct written by ZBA 21 electron beam pattern generator together with all corresponding microprocesses. Well controlled and resolved details (spaces) between individual quasi-square structures of the final large area neural holography chip were achieved in the range of about 50 nm.

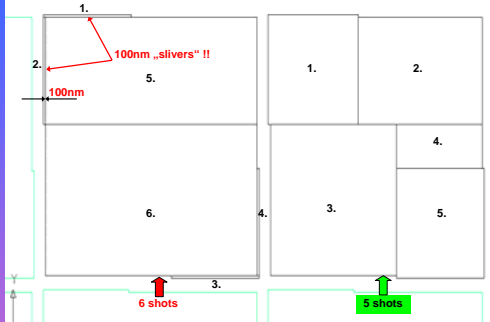
Motivation :

- ✓ Optimization of the complicated geometry of randomly distributed individual features inside a computer generated holographic chip with sharp-local changes in the patternload over a relatively large area (1cm x 1cm and more).
- ✓ Improvement of the fragmentation software with multiple choices of the workfields grouping together with postprocessing of the fragmented data in order to reduce undesired boundaries between neighboring fragmented data areas.
- ✓ Data compilation software with emphasis of exposure corrections and further solving of the data transfer into the main operating system and improvement of the large-files data transfer into the operating system of the pattern generator.
- ✓ Exposure optimization (proximity effect correction for the EBDW) in dependence of the used resist materials before and after the exposure (for UV, DUV and EBDW lithography).
- ✓ Transfer of the patterns into thin resist layers deposited on a substrate by means of UV, DUV and electron-beam lithography (EBDW).

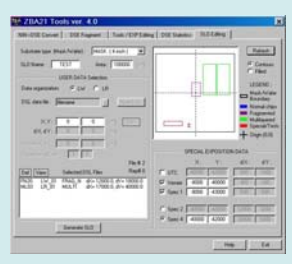
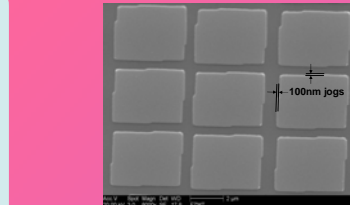
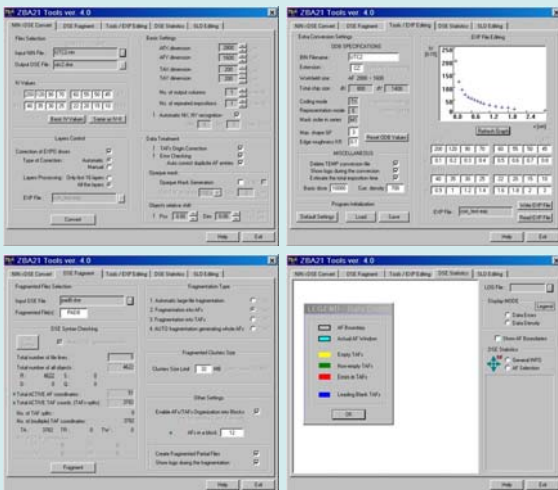


Example of a process dependent dose-correction curve for isolated lines in PMMA resist

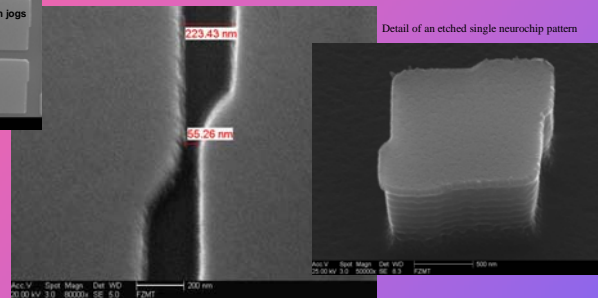
Splitting of polygons into rectangles (single exposure shots).



Used data compilation software

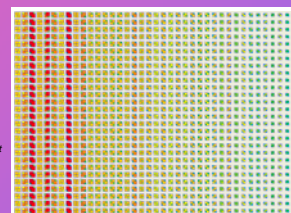


Achieved Results

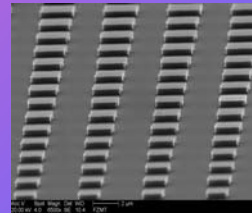


Cr mask array structures on Si substrate after lift-off with sub-100 nm gaps

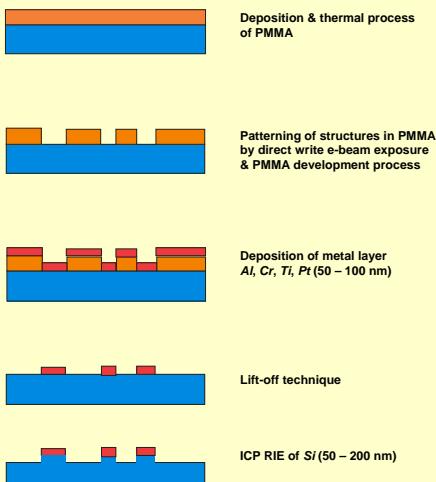
Cut-out of the fractured dose-corrected exposure pattern data (each color means a particular dose assignment)



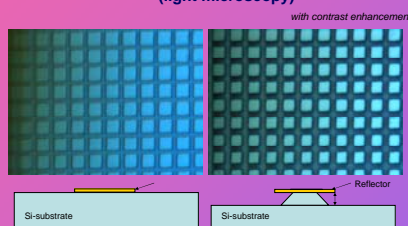
Array of etched Cr-reflectors



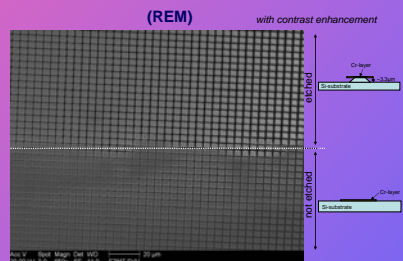
Simplified neurochips fabrication process flow



Holographic Neurochip (light microscopy)



Holographic Neurochip (REM)



Reflections from the neurochip test (light microscopy)



Undercutted Cr reflectors on Si substrate

