Recent Advances in Petabyte Optical Data Storage and Quantum Optical Lithography

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In this presentation we report novel results for 3D recording an optical disc with ultra-high density of 6 PB and 1nm Quantum Optical Lithography.

Multilayer 5nm nanomarks were experimentally obtained by using fluorescent photosensitive glass-ceramics and an optical head with λ=650 nm and NA=0.60. Ultra-high density optical data were recorded by focusing laser beam of a CW laser diode operating at low power (P_{max} = 10 mW).

Direct Laser Writing (DLW) optical lithography uses photons instead of electrons (Electron Beam Lithography-EBL). Because it is a maskless technique, DLW has a high flexibility, being able to work with various shapes of the patterns. Optical diffraction limit imposes a barrier below 210 nm. We have developed novel optical lithography instruments, and lithography techniques for the fabrication of complex nanostructures. Quantum Optical Lithography could produce complex patterns at nanoscale dimensions. 1 nm, 2 nm and 5 nm resolution, by optical means, using new materials (fluorescent photosensitive glass-ceramics and ultra-thin QMC-5 resist) have been demonstrated.

References

1. E. Pavel, "Coherent exciton mechanism of three-dimensional quantum optical lithography", *Applied Optics,* 54 (2015), 4613- 4616

2. E. Pavel, S. Jinga, B.S. Vasile, A. Dinescu, R. Trusca and N. Tosa, "3D Direct Laser Writing of Petabyte Optical Disc ", *Optics and Laser Technology,* 71 (2015), 45-49

3. E. Pavel, S. Jinga, B.S. Vasile, A. Dinescu, V. Marinescu, R. Trusca and N. Tosa, "Quantum Optical Lithography from 1 nm resolution to pattern transfer on silicon wafer", *Optics and Laser Technology,* 60 (2014) 80–84

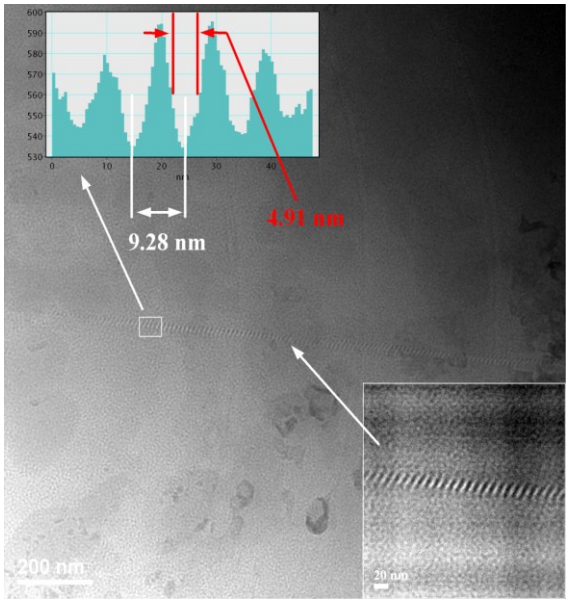

Fig. 1 TEM image of a cross-section of 5 nm parallel lines.

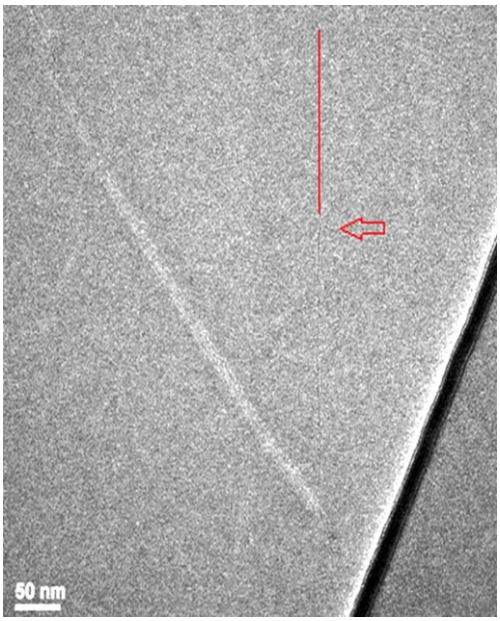

Fig. 2 TEM image of 1 nm line.