Nanostructured surfaces

The nanostructuring of surfaces and films using interference lithography and chalcogenide photoresist

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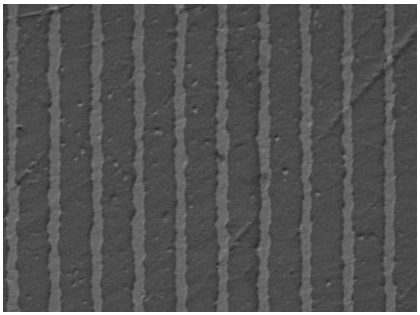
One of the most technological method for fabrication of periodic nano- and microstructures, production of the master mold for nanoimprinting lithography, formation of grating structures on semiconductor surfaces, and others is interference (interferometric) lithography. In combination with chalcogenide photoresists, that characterized by high resolution, optical uniformity, and high refractive index, this method allow to obtain the sub-100 nm critical sizes of the formed periodic structures even at recording by the laser radiation of visible range. In this work it is shown the results of investigation of nanostructuring of surfaces and films using As-S-Se and Ge-Se photoresists.

The chalcogenide layers for interference pattern recording were deposited on polished glass or Si surface using thermal vacuum evaporation. For decreasing of interference pattern period glass prisms with refractive index ranging from 1.5 to 2.0 were used. The prepared samples were exposed by interferential pattern that was generated by a helium-cadmium laser (wavelength of 440 nm) using the holographic setup assembled by the wave-amplitude division method. After exposure, the samples were chemically treated in non-water alkaline organic solutions to form a relief pattern or lithographic mask.



This technology has been used for the fabrication of one- and two-dimentional periodic structures with spatial frequency up to 5000 mm^{-1}. As an example, Fig. presents electron microscopic image of the gold nanowires (period - 550 nm, width of the wire - about 110 nm, thickness - 40 nm) on the surface of gallium arsenide wafer. Such structures are used in opto-chemical sensors based on plasmonic systems. The interference techniques, used chalcogenide photoresists, a simple, inexpensive, and adaptable to large-scale manufacturing.