SUBSTRATE NANOPROFILING FOR HETEROEPITAXY OF HIGH-Z SEMICONDUCTOR COMPOUNDS

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The present paper reports on the Electron Beam Lithography (EBL) fabrication of different nanoprofiled substrates (Si, sapphire, glass, etc.) for the subsequent epitaxial growth of $Hg_{1-x}Cd_xI_2$ and CdTe-based heterostructures.

Epitaxial growth of these semiconductor compounds, which are high-Z wide bandgap semiconductors of the type II-VII_2 and II-VI, respectively, is strongly limited by the lack of commercially available lattice matched substrates [1,2]. Actually, these materials are generating great interest because their properties are well suited for the fabrication of nuclear radiation detectors operating at room temperature [3] and photonics applications [4].

The nanoprofiling process consisted of two subsequent technological steps such as EBL patterning and reactive ion beam etching (RIBE). The EBL pattern definition was performed with a Scanning Electron Microscope (SEM, LEO 1455) equipped with a LaB_6 filament. The exposures were made at 25 kV and the resist employed was 950K PMMA A4. The thickness of a spin coated PMMA layer onto substrate was varied in the range of 0.2-0.3 μm. The PMMA coated substrate was baked at 170ºC for 75 min. The develop was made using MIBK: IPA 1:3 solution for 1min to get the highest resolution. After, 10nm thick Cr adhesion layer and Au layer with different thickness ware deposited. The lift-off process was carried out in a acetone bath at room temperature, followed by rinses in IPA. The final substrate surface nanopattern was created by RIBE.

References:

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[3] N.V.Sochinskii, V.Muñoz, J.M.Perez, J.Cárabe, A.Morales. Appl. Phys. Lett. 72, 2023-2025 (1998).
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Figures:

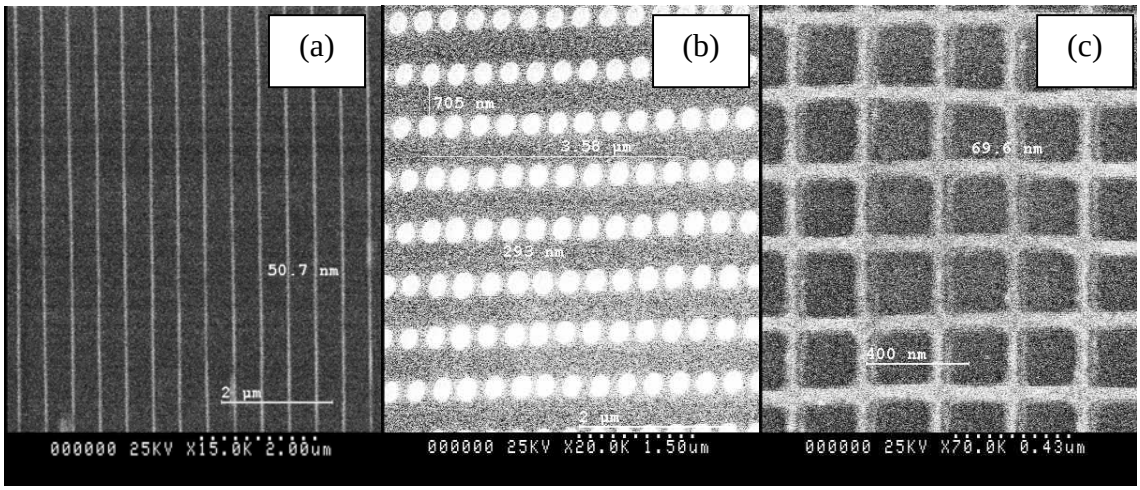

Fig.1. SEM images Si nanoprofiled substrates with different surface topography patterns: (a) lines, (b) dots and (c) lattice.