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SUB-MICRON PERIOD GRATING STRUCTURES IN Ta_2O_5 THIN OXIDE FILMS PATTERNED USING UV LASER POST-EXPOSURE CHEMICALLY ASSISTED SELECTIVE ETCHING, S.Pissadakis*, A.Ikiades, Foundation for Research & Technology-Hellas, Institute of Electronic Structure and Laser, PO Box 1527, Heraklion 71110, Greece, C.Y.Tai, N.P.Sessions, J.S.Wilkinson, Optoelectronics Research Centre, University of Southampton, SO17 1BJ, Southampton, UK

Thin polycrystalline films of Ta_2O_5 having high chemical resistance and large dielectric permittivity may be deposited by sputtering and have many applications in microelectronics and optoelectronics. A high-resolution and low-damage method for patterning relief structures in thin Ta_2O_5 films by chemically assisted UV laser selective etching is presented. The method is based in the initial exposure of the Ta_2O_5 films to pulsed UV radiation (quadrupled Nd:YAG laser at 266nm) at fluences below the ablation threshold, for the creation of volume damage in the exposed areas. Subsequent immersion of the exposed sample in a KOH solution results in selective etching of the UV-exposed areas, developing relief structures of high quality. Interferometric exposure was used for the patterning of such gratings with periods shorter than 500nm in films of thickness between 100nm and 500nm. The behaviour of the patterning process is studied using diffraction efficiency measurements, AFM and SEM scans. Diffraction efficiency increases by a factor of 66, compared to the undeveloped structure, were obtained for gratings exposed with 1000 pulses of 30mJ/cm^2 energy density, which were developed in a KOH solution of 50% weight concentration at a temperature of 55°C for 165mins. The etching method presented is being applied to the fabrication of optical waveguide gratings for telecommunication applications. Potential development of 2-D photonic crystal structures using this process is under investigation.

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