Periodiškai nanostruktūrizuotos optinės dangos, skirtos lazerio šviesos valdymui

Periodically nanostructured optical coatings for the manipulation of laser radiation

Lina Grinevičiūtė[1], Julianija Nikitina[1], Ceren Babayigit[2], Darius Gailevičius[3,4], Tomas Tolenis[1], Martynas Peckus[3], Kęstutis Staliūnas[3,5,6]

1.Center for Physical Sciences and Technology, Savanoriu Ave. 231, LT-02300 Vilnius, Lithuania
2. TOBB University of Economics and Technology, Söğütözü Str. 43, 06510, Ankara, Turkey
3. Vilnius University, Faculty of Physics, Laser Research Center, Sauletekio Ave. 10, Vilnius, Lithuania
4. Femtika, Sauletekio Ave. 15, LT-10224, Vilnius, Lithuania
5. ICREA, Passeig Lluís Companys 23, 08010, Barcelona, Spain
6. UPC, Dep. de Fisica, Rambla Sant Nebridi 22, 08222, Terrassa (Barcelona) Spain
lina.grineviciute@ftmc.lt

In micro-lasers, especially in high power emission regimes, the spatial quality of laser light beam deteriorates, i.e. the energy distribution deviates from the Gaussian form. Typically, a confocal arrangement of lenses with a diaphragm in the focal plane is used for intracavity spatial filtering. Such conventional filtering requires access to the far-field domain. In microlasers, however, conventional filtering is impossible due to the lack of space in micro-resonators to access the far-field. Therefore, a novel concept for more compact and efficient spatial filtering is necessary.

In this study, we propose and demonstrate a conceptually novel mechanism of spatial filtering in the near-field domain, by a nanostructured multilayer coating - a 2D photonic crystal structure with a periodic index modulation along the longitudinal and transverse directions to the beam propagation (see Fig.1) [1]. The structure is built on a nano-modulated substrate, which provides the transverse periodicity. The physical vapor deposition of materials with different refractive indexes is used for the self-repeating modulation in the longitudinal direction.

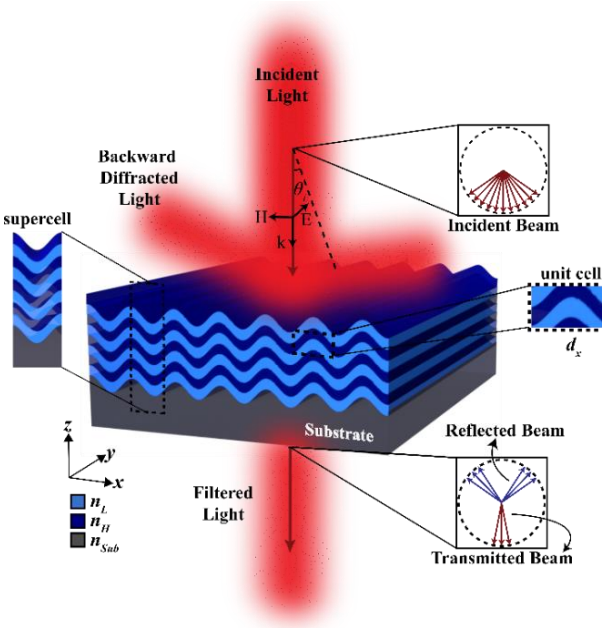

Fig. 1 The schematic representation of designed Photonic Crystal with angular selectivity

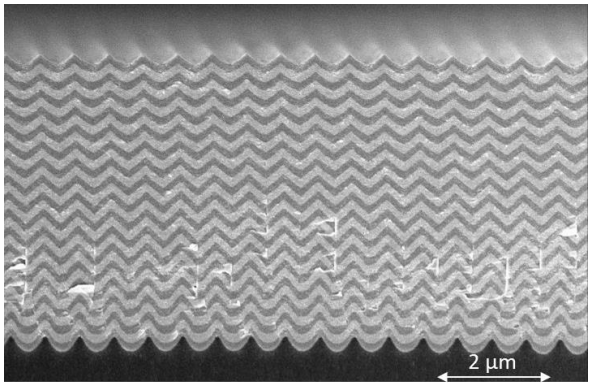

Fig. 2 SEM image of the cross-section of the fabricated structure

We experimentally demonstrate a 5 µm thick photonic multilayer structure composed of nanostructured layers of alternating high- and low-index materials (Nb_2O_5 and HfO_2, respectively) providing angular selectivity in the near-infrared frequencies with 2° low angle passband. The proposed 2D photonic structure can be considered as a promising component for intracavity spatial filtering even in high power microlasers systems.

In the presentation, the investigation of different technologies for the single layer and multilayer coating deposition on nanostructured surfaces will be reviewed. The focus will be on the possibility to form the dielectric structures with periodic modulation of optical constants by Ion Beam Sputtering technology together with the application of angular filtering of light [1,2].

Key words: optical coatings, ion beam sputtering, nanostructured surface, angular and frequency selectivity.

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Literature

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[2] L. Grineviciute, J. Nikitina, C. Babayigit, K. Staliunas, *Applied Physics Letters* 118, 131114, 2021