Optical Response of Nanosculptured Bragg Microcavities Prepared by Physical Vapor Deposition at Glancing Angles

M. Oliva-Ramírez, F. Yubero, A. Barranco, A.R. González-Elipe

Nanotechnology on Srufaces laboratory. Instituto de Ciencia de Materiales de Sevilla (CSIC-Univ. Sevilla), c/ Américo Vespucio nº49, Sevilla, Spain. http://www.sincaf-icmse.es/
manuel.oliva@icmse.csic.es

Abstract

This paper reports the fabrication, characterization and study of the optical properties of porous Bragg microcavities formed by the stacking of a series of porous nanocolumnar layers of different refraction index materials (SiO_2 and TiO_2) which are deposited by physical vapor deposition at glancing angles (GLAD) [1, 2]. Nanosculptured microcavities with different optical properties and formed by tilted nanocolumns can be obtained by adjusting the stacking sequence of porouos TiO_2 and SiO_2 layers with well defined thickness and porosities. Both the refraction index and the thickness of the individual layers can be controlled by changing the zenithal evaporation angle and the azhimutal orientation of the substrates with respect to the evaporation target [3]. Figure 1 (a) (b) shows a series of selected SEM micrographs of some microstructures attainable by this method, as well as some schemes describing the organization of the nanocolumns in the different layers. Differences in the optical response of the different microcavities have been related both with the thickness of the layers and the different growth mode (i.e. orientation of the nanocolumns) of the stacked layers. Figure 1c) shows a typical transmission spectrum of one of these microcavities. The azimuthal and zenithal optical responses of these colored devices (Figure 1d)) have been studied and related with their particular microstructure. These Bragg microcavities experienced changes in their optical behavior when they were infiltrated with liquids (Figure 1c) and have resulted ideal for optofluidic applications and as liquid sensors to determine the concentration of different solutions.

Figures

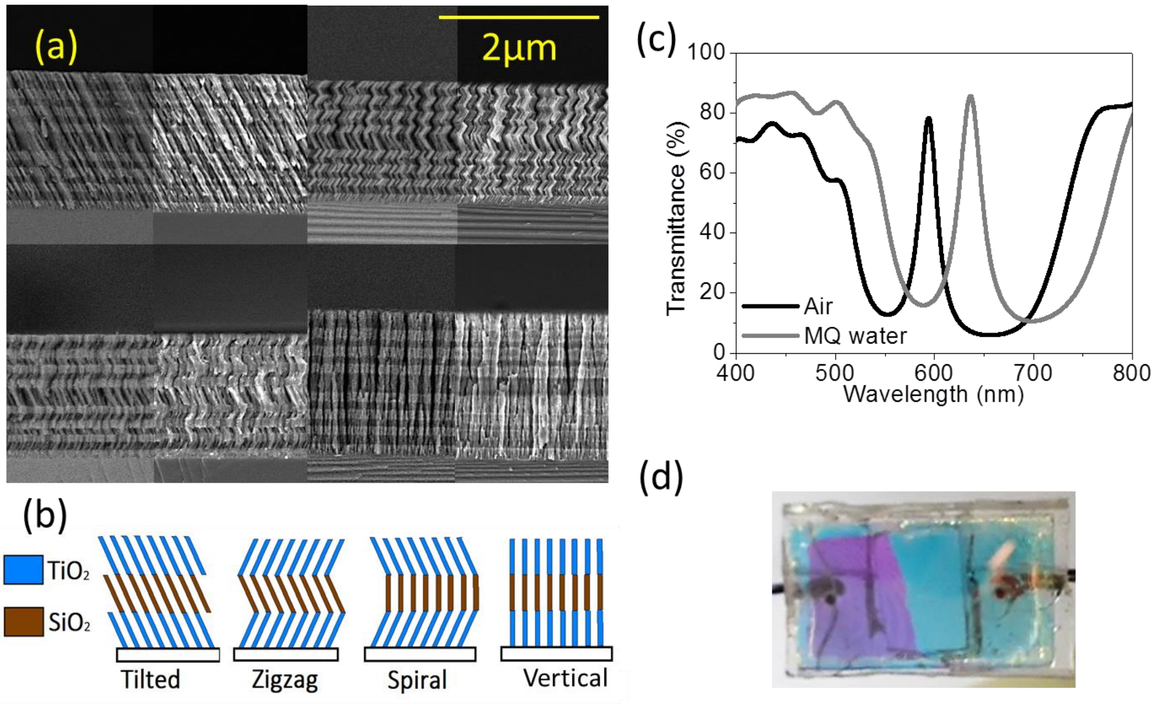

Figure 1.- a) Selected SEM micrographs obtained for Bragg microcavities prepared by physical vapor deposition at glancing angles of successive SiO2 and TiO2 layers. b) Scheme describing the arrangement of the nanocolumns depending on the evaporation geometry. c) Transmission spectrum of a microcavitiy empty and full with water. D) Aspect of the microcavities when a liquid is filling their pores.

References

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