PO2026

Propagation of the microstructure and engineering the humidity tightness in multilayer thin films prepared by magnetron sputtering at oblique angles

Alberto Palmero[1], Aurelio Garcia-Valenzuela[2], María del Carmen Lopez-Santos[2], Rafael Alvarez[3], Victor Rico[2], Ana Isabel Borrás[2], Rafael C. del Campo[4], Miguel Holgado[5], Agustín R. Gonzalez-Elipe[2], José Cotrino[3]

[1]Materials Science Institute of Seville, Seville, Spain [2]ICMS (CSIC-US), Seville, Spain [3]University of Seville, Seville, Spain [4]Universidad Politecnica de Madrid, Madrid, Spain [5]Universidad Politécnica de Madrid, Madrid, Spain

alberto.palmero@csic.es

We analyze an undesired phenomenon that takes place when growing porous/compact multilayer systems by alternatively using the oblique angle and the classical configuration by magnetron sputtering. We show that compact layers develop numerous fissures rooted on the open porous structures of the layer below, in a phenomenon that becomes amplified when increasing the number of stacked layers and that might cause the loss of structural control. An undesired phenomenon found in thin films and multilayers intended for photonic applications (e.g., antireflective coatings, 1D- Bragg mirrors and microcavities, etc.) is the condensation of water within the pores that makes the optical behaviour of the systems unpredictable and may lead to their accelerated degradation. In this work we propose a strategy to minimize this phenomenon by growing a thin and continuous accommodation layer on top of the porous film under the impingement of plasma ions, where the compact layer may subsequently grow homogeneously. This approach has been tested in practical situations by growing compact TiO_2/porous SiO_2 and porous SiO_x/porous SiO_2 multilayer systems intended for advanced photonic, optofluidic and near-IR mirror applications, from which preliminary results will be also presented. In these system a precise control over the microstructure and optical properties of the films/multilayers has been achieved using the said accommodation layer strategy.

Keywords
Porous Film
Multilayer Structures
Photonic Crystals
Humidity Tightness
OAD