PO2024

Growth of porous thin films by reactive magnetron sputtering using particle collimators

Rafael Alvarez[1], Aurelio Garcia-Valenzuela[2], Victor Rico[2], Jose Cotrino[3], Agustin R. Gonzalez-Elipe[2], Alberto Palmero[2]

[1]Dept. Applied Physics I (US), Seville, Spain [2]ICMS (CSIC-US), Seville, Spain [3] Universidad de Sevilla, Seville, Spain

rafael.alvarez@icmse.csic.es

In this paper we have analyzed the influence of particle collimators to selectively deposit species with preferential directionality in the magnetron sputtering deposition of thin films. Using wisely-designed collimators, tilted nanocolumnar morphologies are grown in a ballistic deposition regime, i.e. when most deposition species arrive at the film surface along well-defined oblique preferential directions, and also in a thermalized deposition regime, when these species follow an isotropic momentum distribution in the plasma gas. The obtained results suggest that the use of particle collimators may promote the growth of porous thin films even in the classical magnetron sputtering configuration, when the target and the substrate are parallel. General insights are given on this approach and, as a proof of concept, its principles applied for the synthesis of nanostructured films in a laboratory-size reactor. Evidences of this possibility have been obtained for a series of TiO_2 thin films prepared with this methodology. These results have allowed the extension of this technique to other plasma-assisted deposition methods, such as Plasma Enhanced Chemical Vapor Deposition (PECVD).

Keywords
Porous Thin Films
Magnetron Sputtering
Particle Collimators
Directionality Control
Nanocolumns