Influence of deposition parameters on the closed porous structure of magnetron sputtered amorphous silicon coatings


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Over the last decade the research in nanoporous materials is a growing field facing a wide range of technological challenges. We recently proposed a new approach for the production of amorphous porous silicon coatings with closed porosity by He driven magnetron sputtering [1]. Our method is a versatile alternative to the traditional electrochemical methods and it allows preparing porous silicon coatings with tailored refractive index and over a wide range of substrates from glass to flexible materials.

Theoretical models are been applied to help the understanding of the mechanism beyond the formation of the closed porosity (see contribution “Simulation and growth of porous silicon coatings by magnetron sputtering” presented to this conference)

However, the understanding of the influence deposition parameters on the microstructure of these coatings requires detailed characterization of latter. This work presents an extended characterization at the microstructural level of closed porous silicon coatings, deposited by magnetron sputtering at Oblique Angle Deposition, as a function of deposition parameters. The coatings studied were deposited with the magnetron head placed at 30º angle with the normal to the substrate holder and the cathode at a distance of 5cm from the substrate. The structure of the coatings is composed by closed nanopores (sizes ranging 2-40 nm) oriented on the magnetron direction. Changing the power supplied to the magnetron it is possible to control pore size distribution, decreasing power results in smaller pores. Also the orientation of the pores can be modified without changing the magnetron position by adjusting the pressure (10 to 20º angles are achieved for the same magnetron position). The influence of other parameters as substrate bias and temperature are also investigated. A structural zone scheme for the dependence of the microstructure on the deposition parameters for these singular coatings is proposed.


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