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SiOx by magnetron sputtered revisited: tailoring 2D compositional patterns and photonic properties of multilayers

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Silicon oxide is a classical material which, prepared by a large variety of methods, has been profusely investigated for a large set of applications. In this paper we present some recent results concerning the control of stoichiometry and nanostructure of SiOx (x<2) thin films prepared by reactive magnetron sputtering (MS). Using an oblique angle deposition geometry [1] and properly adjusting the oxygen partial pressure in the plasma gas we have shown that it is possible to achieve a very precise control over the composition (i.e. x value) and porosity of these thin films and, consequently, their optical properties. We illustrate the possibilities of this precise management of thin film properties with two application cases, the preparation of 2D compositional patterns and the fabrication of 1D SiO_2/SiO_x photonic multilayers. As illustrated by the AFM-Raman map in Figure 1, the control of the collisional regimes of sputtered silicon particles in their trajectory to the substrate [2] leads to a local periodic variation of composition in SiOx thin films deposited on a patterned substrate. Meanwhile, the dependence of refraction index of the SiOx thin films on their stoichiometry and porosity has permitted the fabrication of 1D porous multilayers in the form of Bragg reflectors or Bragg microcavities that may act as suitable near infrared photonic sensors through the infiltration of liquids.

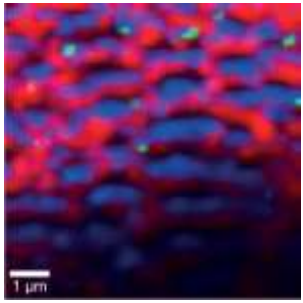

Figure 1.- AFM-Raman map of the chemical patterns obtained by MS deposition of SiOx at oblique angles

[1] A. Barranco, A .Borrás, A.R. Gonzalez-Elipe, A. Palmero. Progress in Materials Science **76**, 59 (2016)

[2] A. García-Valenzuela, R. Alvarez, C. López-Santos, F.J. Ferrer, V. Rico, E. Guillen, M. Alcon-Camas, R. Escobar-Galindo, A.R. González-Elipe, A. Palmero, Plasma Proc. Polym. **13**, 1242 (2016).