ELECTROPHORETIC DEPOSITION OF SNO2 NANOSTRUCTURED THICK FILMS FOR CO SENSING

Paula M. Vilarinho, University of Aveiro, Portugal
paula.vilarinho@ua.pt
Alexandre Santos, University of Aveiro, Portugal
Elizabete Costa, University of Aveiro, Portugal

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Tin oxide (SnO_2) is a semiconductor with a n-type large band gap (3.6 eV), high chemical stability and good optical and electrical properties. These attributes justify the current widely use of SnO_2 in various devices like transparent conducting electrodes, dye-sensitized solar cells, catalytic support materials, high-capacity lithium-storage, electrochemical or photo electrochemical based energy conversions, and gas sensors [1]. Presently nanostructured materials are considered as a key solution for the development of any room-temperature sensing platform [2]. Literature reports the usage of SnO_2 nanoparticles in gas sensors due to their comparatively high surface area and easy adsorption of oxygen on its surface, low operating temperature, small dimensions, low cost and high reliability [3]. As a consequence SnO_2 nanostructured based gas sensors have high aptitude in detecting gases as methane (CH_4), nitrogen dioxide (NO_2) and carbon monoxide (CO) [3]. The performance of gas sensors is also dependent on the sensing material microstructure, as grain size, film thickness and porosity. For example selectivity can be regulated by porosity and film thickness. Among the different film processing techniques Electrophoretic Deposition (EPD) presents unique advantages that include deposition of conformal coatings on complex shape substrates, high flexibility, low cost and simplicity that are worth to exploit when fabricating gas sensing thick films. EPD consists in applying a AC or DC current to charged particles and promote their movement in a liquid suspension until they deposit on a substrate. A key feature in EPD is the stability of the suspension that depends directly on the suspension media and additives but also on the morphology of the particles. Within this context in this work we exploit the role of the morphology of SnO_2 nanostructures (nanoparticles and nanorods) in EPD of SnO_2 thick films for CO sensors. Powders were synthesised by hydrothermal method under different conditions. Suspension stability is addressed by zeta potential, UV transmittance and particle size distribution measurements in different media/additive, as ethanol, triethanolamine (TEA) and iodine. Relations between particle morphology - suspension behaviour – film morphology – sensing performance are established and discussed (Figure1).

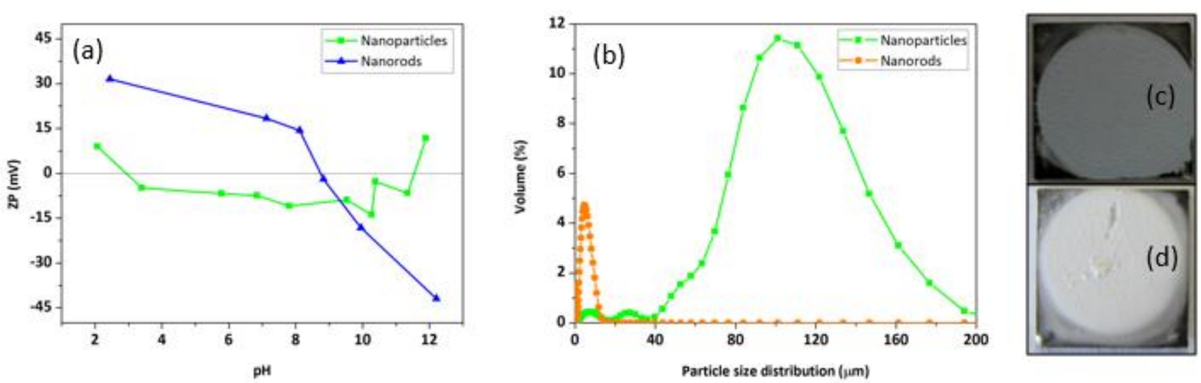

Figure 1: Zeta potential (a) particle size distribution (b) for suspensions of nanoparticles and nanorods; surface morphology of SnO_2 films deposited with nanorods (c) and nanoparticles (d) and sintered at 500 °C for 2 h.

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