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TiO_2 nano composite thin films texture and properties in self-cleaning process

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Titanium Dioxide (TiO_2) has been considered as an ideal photocatalyst due to its chemical properties. This paper is discusses about how TiO_2 nanoparticle in a thin film work as a photocatalyst for self-cleaning purpose and in future we prove how doping increase photocatalytic activation in visible light range. In this work, nanostructured TiO_2 thin films were grown by spray pyrolysis technique on glass substrates at 400°C. TiO_2 thin films were then annealed at 600-1000°C in the air for a period of 3 hours. The samples were characterized at several views; thickness of the films was measured by Focused Ion Beam (FIB) and field ion beam. The effect of annealing on the structure, morphology and optical properties was studied. The X-ray diffraction (XRD) and Atomic Force Microscopy (AFM) measurements confirmed that the films grown by this technique have good crystalline structure and homogeneous surface. The study also reveals that the RMS value of thin film roughness increased with increasing annealing temperature. The optical properties of the films were studied by UV-Vis spectrophotometer. The optical transmission results showed that the transmission over ~65%, which decrease with the increasing of annealing temperatures.

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Synthesis of dense and porous nanofibers by electrospinning

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The main goals of this research were morphology and structural control of electrospun ceramic nanofibers. We studied the interplay between the tip to collector distance (TCD), applied potential, precursor viscosity and the fiber diameter distribution. Adjustment of the precursor viscosity by dilution was found to be the useful way to control the fiber diameter in the 100-800 nm range. In a high viscosity sol a transition from a single to a bimodal distribution was observed at an electric field of 0.8 kV cm-1. In a low viscosity sol, a sharp step-like transition from a large to a small fibers diameter regime at the same electric field was occurred. We demonstrate how to control the branching effect to yield either single or bimodal fiber distribution in wide diameter range. The thermal behavior of "green" PZT nanofibers was studied by TGA/DTA/DTG analysis coupled with MS. A pre-firing stage at 350oC was found to be necessary to maintain the fiber structure. Sintering of pre-fired fibers was executed in two ways: a long procedure at 650oC for 2 hr and by rapid thermal processing (RTP) at 500-800oC for 30 sec. RTP at 800°C provides formation of perovskite phase similar to long sintering with minimal lead loss via evaporation. Finally, the sensing ability of the prepared PZT nanofiber mats was tested under cyclic mechanical loading. In conclusion, the combination of morphology control, pre-firing and RTP might be used as an efficient procedure for dense PZT ceramic nanofibers preparation.

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