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GROWTH OF VARIOUS NANOARCHITECTURES OF F^--DOPED TIN OXIDE IN THE ATOMIZED SPRAY PYROLYTIC DEPOSITION ON GLASS SURFACES: A STUDY OF THE MECHANISM OF GROWTH

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In this research, preparation of different nanoarchitectures of FTO has been accomplished, using the Atomized Spray Pyrolysis Technique, where a flow of aerosol of the precursor solution is directed over the substrate surface, heated to 500°C, in a horizontal direction. The precursor solution is composed of 0.50 g $SnCl_4.5H_2O$, 1.50 g NH_4F, 4.00 mL acetone, 10.0 mL of 0.100 M HCl and 46.0 mL of distilled water. The initially formed FTO contains elongated hexagons of FTO particles with FTO:void ratio of 3:1 and a 0.8% of doping density of F^-. As the spraying proceeds, the particles become more symmetrical, and act as seed particles for subsequent growth. The initial erection from the edge atoms of crystallites results in the formation of FTO nanotubes of hexagonal cross-section, with a 1.8% doping density of F^-. The slower growth from the middle atoms of crystallites gradually fills the nanotubes, to eventually end up in FTO nanorods. The growth from the central atoms of the nanocrystallites still continues a little further, to give a pencil-shape to the nanorods. Further spraying covers the nanorod architecture with extensively cross-linked, pencil-like FTO nanorods. As such, the same technique can be used to synthesize different nanostructures of FTO nanomaterials, and the kinetics of the growth of nanomaterials determines the kind of nanomaterial resulted and also sets the mechanism of their growth.