Nanocomposites and nanomaterials

Synthesis and crystal structure of TiO_X nanoparticles

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TiO_2 is a general material for many optoelectronic applications such as solar cell and photodetector. In this study, the TiO_x nanoparticles have been synthesized by drying method. The microstructure, morphology, and composition of synthesized TiO_x nanoparticles were characterized by X-Ray diffraction (XRD), scanning electron microscopy (SEM) and energy dispersive spectrometer (EDS), respectively. Fig.(a) shows the XRD patterns of TiO_x nanoparticles were annealed at different temperatures from 500 ºC to 700 ºC, and the anatase-rutile phase transformation of produced TiO_x nanoparticles took place at the annealing temperature of over 500 ºC. This demonstrated that 500 ºC is the appropriate temperature to obtain TiO_x anatase-phase nanoparticles. Thus, we fixed a working temperature of 500 ºC, and TiO_x nanoparticles were annealed under three different ambiences: air, N_2, and mixture of N_2 and O_2. As shown in Fig. (b), the TiO_x nanoparticles annealed in gas ambiences possessed stronger X-ray diffraction signals than that those annealed in the air. Fig. (c) showed the compositions of TiO_x nanoparticles annealed under different ambiences at 500 ºC, and Fig.(d) showed the composition of TiO_x thin films which were fabricated by spin coating from the synthesized nanoparticles. According to EDS analysis, both TiO_x nanoparticles and thin film exhibited signals of titania and oxygen. In conclusion, the zero and 2d-dimensions TiO_x nanostructure with anatase and rutile phases have been successfully synthesized and deposited on silicon substrates, and this work provide the broad applications for many fields of TiO_x based devices.

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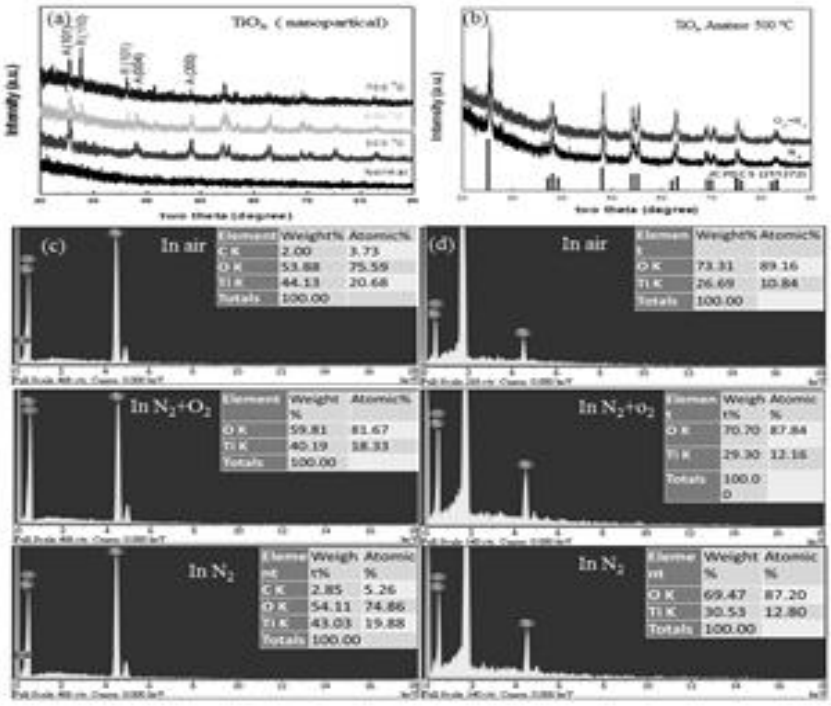

Figs. (a) and (b) are XRD patterns of TiO_x nanoparticles before and after annealed in vacuum at different temperatures and ambiences (N_2, O_2+N_2). Figs. (c) and (d) are EDS results of TiO_x-based nanoparticles and thin film annealed under different ambiences at 500 ºC.