Abstract

We report on a simple and robust analysis of the energy band gap and crystal size of anatase TiO2 thin films on doped Fluorine Tin Oxide (SnO2:F) prepared using sol-gel Doctorblade method. The films had been annealed at rates of 1 oC/Min, 2oC/Min, 1-step and referenced with as-deposited film, and the optical and structural properties characterized using UV-VIS spectrophotometer and X-ray diffraction (XRD), respectively. The films had a refractive index which was noted to depend on the annealing rate consistent with Cauchy's relation. An optical band gap of 3.88eV , 3.72eV , 3.33eV , and 3.13eV was measured on the as-deposited, 1-Step, 2 oC/Min and 1oC/Min annealing, respectively. Optical conductivity was highest in the UV region and diminished sharply in the visible region in all the annealed samples. The as-deposited film exhibited a diminished optical conductivity in the visible electromagnetic field due to high density of charge trapping sites resulting to negligible interaction of the film molecules with the applied electric field. The XRD spectra revealed thermal enhancement in crystallinity, with the crystallite sizes of 21.8382nm, 24.3087nm and 24.9633nm, for 1-step annealed, 2oC/Min and 1 oC/Min, respectively. The broadened XRD spectrum of the as-deposited film is attributed to the presence of dangling bonds that act as trapping sites. Comparison of the measured values of the optical band gap with simulation from SCOUT at low annealing rates (2oC/min and 1oC/min) was found to decrease with enhancement in crystallite size, indicating a reduction in porosity and improvement in both densification and crystallinity of the films.