The properties of sonicated immersion grown hematite films at various annealing temperatures

ABSTRACT

In this research, hematite (α-Fe2O3) film was synthesized to study the effect of annealing temperature on its crystallinity, optical and electrical properties. Through a sonicated solution immersion technique, hematite films were deposited on a fluorine-doped tin oxide (FTO) glass substrate. In the synthesis process, 0.2 M ferric chloride (FeCl3·6H2O) was used as a precursor, 0.2 M urea (NH2CONH2) as the stabilizer, and de-ionized (DI) water as a solvent to produce 200 ml of aqueous solution. During the annealing treatment, we varied the temperatures at 350 ºC, 450 ºC and 500 ºC. The X-ray diffraction (XRD) pattern revealed the presence of peaks of 2θ angles between 20° to 90°, corresponding to (104), (110), (214), (125) and (128) planes, which exhibited crystalline structures of rhombohedral with diffraction peaks of hematite phase (α-Fe2O3). Optical characterizations showed that the transmittances of all samples were close to 100% in the high wavelength level of the visible light region, which is close to the infrared spectrum. Absorption of hematite samples was found to be more than 0.6 a.u. in the low wavelength level of the visible light region close to the ultraviolet spectrum and close to 0 in the high wavelength level of the visible light region close to the infrared spectrum. A sample with an annealing temperature of 500 °C has the lowest transmission and the highest absorbance in the visible region due to dim pigments in the hematite film.