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Low-temperature-dependent growth of titanium dioxide nanorod arrays in an improved aqueous chemical growth method for photoelectrochemical ultraviolet sensing

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Abstract


The growth of titanium dioxide nanorod arrays (TNAs) in aqueous solutions containing titanium butoxide and hydrochloric acid can be controlled by regulating the temperature from 115 to 150 degrees C as an adjustable physical parameter. The transparent colloidal solution of titanates is clouded on the basic growth of TNAs when heated at a certain temperature using an improved aqueous chemical growth method in a clamped Schott bottle. The structural, optical and electrical properties of grown TNAs films were thoroughly investigated and discussed. The distinct and high-intensity peaks observed in the X-ray diffraction pattern and Raman spectra of the grown TNAs show the rutile phase with high crystal quality. The crystallite size, diameter size, and thickness of TNAs decrease with decreasing growth temperature. The prepared TNAs were used to detect 365nm ultraviolet (UV) photon energy (750 mu W/cm(2)) in a photoelectrochemical cell structure with a maximum photocurrent of 26.31 mu A and minimum photocurrent of 3.48 mu A recorded for TNAs grown at 150 degrees C and 115 degrees C, respectively. The size, structural properties, charge transfer resistance, and electron lifetime play a key role in determining the UV sensing characteristics of the TNAs. Results show that TNAs are very promising in fabricating a UV sensor with a high response at 0V bias even at a low growth temperature of 115 degrees C.

Keywords

Keywords Plus: RUTILE TiO2 NANORODS; TUNABLE PROPERTIES INFLUENCE; SENSITIZED SOLAR-CELLS; NANOWIRE ARRAYS; THIN-FILMS; PHOTOCATALYTIC PROPERTIES; HIERARCHICAL STRUCTURES; HYDROTHERMAL METHOD; REACTION-TIME; ANATASE

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