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Volume 30, Issue 2, 30 January 2019, Pages 1017-1033

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

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Abstract

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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 °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 365 nm ultraviolet (UV) photon energy (750 μW/cm²) in a photoelectrochemical cell structure with a maximum photocurrent of 26.31 μA and minimum photocurrent of 3.48 μA recorded for TNAs grown at 150 °C and 115 °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 0 V bias even at a low growth temperature of 115 °C. © 2018, Springer Science+Business Media, LLC, part of Springer Nature.

SciVal Topic Prominence

Topic: Photodetectors | Nanowires | ultraviolet photodetectors

Prominence percentile: 99.480 

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Engineering uncontrolled terms

Aqueous chemical growth

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IMRC/AISTDF/ R&D/P-1/2017		

Funding text

Acknowledgements This work was supported by the ASEAN-India Research & Training Fellowship Scheme (IMRC/AISTDF/ R&D/P-1/2017). The authors also would like to thank the Institute of Research Management and Innovation (IRMI) of UiTM and the International Islamic University Malaysia (IIUM) for their financial support of this research.

ISSN: 09574522

Source Type: Journal

Original language: English

DOI: 10.1007/s10854-018-0371-8

Document Type: Article

Publisher: Springer New York LLC

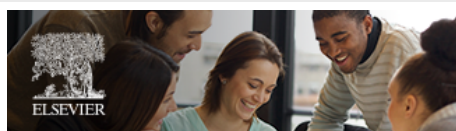
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