t-ZnO based sensor for optical and gas sensing applications

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Abstract. This paper investigates the synthesis, structural characterization, and multifunctional sensing applications of tetrapodal zinc oxide (t-ZnO) networks, grown using the flame transport synthesis (FTS) method. SEM images reveal an interconnected network of ZnO tetrapod with crystalline cores, which provide structural stability and enhance electrical contact for sensing applications. XRD analysis confirms the crystallinity and purity of the ZnO networks.

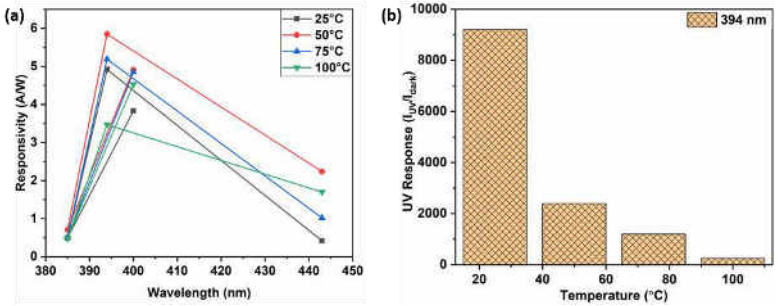

Fig.1. (a) The photo responsivity of t-ZnO networks at different tested wavelengths. (b) The UV response at different operating temperatures.

The photodetection capabilities of t-ZnO were studied under UV and visible light at various temperatures and bias voltages. The highest photo responsivity of 5.85 A/W and external quantum efficiency (EQE) of 1841.1

were achieved at 50°C under 394 nm UV illumination (Fig.1(a)) [1]. The UV response declined with increasing temperature (Fig.1(b)) [1], attributed to bandgap narrowing and increased dark current due to surface oxygen desorption. The paper also explores the gas-sensing capabilities of t-ZnO networks, with selective detection of volatile organic compounds (VOCs) such as n-butanol (Fig.2) [1].

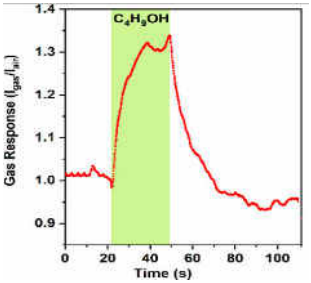

Fig.2. (a) The dynamic gas sensing response of n-butanol at 350 ℃ for 100 ppm concentration.

The sensing mechanism relies on oxygen adsorption-desorption dynamics [2]. Overall, the study highlights the potential of t-ZnO networks for UV photodetection, and gas detection applications, supported by robust structural and electrical properties.

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