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Movlaee K[1,2], Periasamy P[3], Krishnakumar T[4], Ganjali MR[2], Leonardi SG[1], Neri G[1], Murthy Chavali[5], Prem Felix Siril[6], Devarajan V.P[7]

[1]Department of Engineering, University of Messina, 98166 Messina, Italy

[2] Center of Excellence in Electrochemistry, School of Chemistry, College of Science, University of Tehran, Iran

[3] Excel college of Engineering and Technology, Komarapalayam, Namakkal – 637 303, Tamilnadu, India

[4] Tagore Institute of Engineering and Technology, Attur, Salem – 636 112, Tamilnadu, India.

[5]Analytical chemistry & Nanotechnology, VFSTRA University, Guntur – 522 213, Andhra Pradesh, India

[6] School of Basic Sciences, Indian Institute of Technology, Mandi, Mandi – 175 001, India

[7] KSR Arts College for Women, Tiruchengode, Namakkal – 637 214, Tamilnadu, India

Abstract

Tungsten oxide (WO_x) nanoparticles were synthesized by a facile and eco-friendly microwave-assisted hydrothermal method without need for using any surfactant. A thorough investigation was performed in order to elucidate the effects of microwave irradiation time (10, 20 and 30 minutes) on the structural, morphological and optical properties of the as-prepared WO_x. Scanning electron microscopy (SEM) and high-resolution transmission electron microscopy (HRTEM) of the samples revealed the presence of irregular nanosized particles containing some well-structured rod shape particles. Fourier transform infrared spectroscopy (FTIR) and X-ray diffraction (XRD) indicated that these nanoparticles are crystallines with mean crystalline size of about 16 nm exhibiting both monoclinic and orthorhombic WO_x crystal structures. The optical properties were investigated by using ultraviolet visible spectroscopy (UV-VIS) and photoluminescence (PL). A blue-shifted optical absorption spectrum with an enhanced defects emission was observed when it was compared to bulk spectrum of WO_3. Thermal-aged WO_x nanoparticles at mild temperature (350 °C) were also used to fabricate conductometric gas sensors Gas sensing tests showed excellent performance towards ethanol monitoring for each synthesized material. In particular, the highest sensitivity was obtained for the sensor based on WO_x synthesized by 10 minutes irradiation time (S10). At the optimal operating temperature of 300 °C, the S10 sensor showed a response R_a/R_g = 8.5 towards 100 ppm ethanol with fast response time of 10 s, in addition to an excellent selectivity against common interfering gases.

Keywords: *Tungsten Oxide, Microwave irradiation, Nanostructures, Gas sensor, Ethanol.*