

Facile synthesis of nanostructured WO₃ thin films and their characterization for ethanol sensing.

Abstract

A simple technique to fabricate nanostructured WO₃ thin films onto conductometric transducers has been employed for ethanol sensing application. Initially, pure tungsten (W) thin films were deposited onto the substrate employing RF sputterer and followed by an etching process. Three types of etching agent were used: nitric (HNO₃), sulphuric (H₂SO₄), and phosphoric (H₃PO₄) acid. It was found that the surface morphology and crystallinity of the WO₃ films were heavily dependant to the etchants employed during the fabrication process. The developed sensors were tested towards ethanol vapor of different concentrations (10–200 ppm) at temperatures between room and 450 °C. The sensors showed stable and reproducible response at optimum operating temperatures. High sensor response towards vaporized ethanol as well as fast τ_{res} and τ_{rec} was observed during the “adsorption” and “desorption” interval. The recorded maximum response for these devices when exposed towards 100 ppm ethanol was measured to be 8 ($R_o = 4.6 \text{ k}\Omega$), 5.8 ($R_o = 22.5 \text{ G}\Omega$), and 5 ($R_o = 0.29 \text{ M}\Omega$) for HNO₃, H₃PO₄, and H₂SO₄, respectively. The optimum operating temperatures were determined to be 400, 300–380, and 360 °C for the sensors developed using HNO₃, H₃PO₄, and H₂SO₄, respectively.

Keyword: Nanostructures, Thin films, Chemical synthesis, Sputtering, Electrical characterisation, Electrical properties