

Hydrogen sensors based on 2D WO₃ nanosheets prepared by anodization

ABSTRACT

Two dimensional tungsten trioxide (WO₃) films made of nanosheets were prepared using high temperature anodization of tungsten (W) thin films. The W thin films were deposited by R.F. magnetron sputtering onto quartz substrates and then anodized at 50 °C in an aqueous solution containing 1.5 M HNO₃. The structural and morphological properties of the prepared films were fully characterized prior to employing them for hydrogen gas sensing application. The hydrogen gas sensing performance of WO₃ thin films was investigated at different temperatures through the measurement of conductance changes upon gas exposure. Hydrogen gas exposure resulted in the intercalation and subsequent reduction of WO₃ sheets, changing the charge carrier concentration and hence the conductivity of the films. The fabricated sensors were found to exhibit excellent sensitivity and repeatability when they were exposed to hydrogen gas while using air as the carrier gas. The effects of different operating temperatures on the sensitivity of the devices were studied in the range of 20–250 °C. The dynamic response of the 2D WO₃ nanosheets based sensors at different operating temperatures are presented and discussed.

Keyword: Hydrogen; 2D nanostructures; Gas sensing; Anodization; Tungsten trioxide; Surface properties