Novel h-WO_3 gas sensors for detection of environmental pollutance

Viktor Zabolotnii[1], Sarah Ben Haj Fraj[2] and Giovanni Neri[2]

[1]Institute of Atomic Physics and Spectroscopy, University of Latvia, Jelgavas iela 3, Riga LV-1004, Latvia
[2]Department of Engineering, University of Messina, C.da Di Dio, I-98166, Messina, Italy

Email: viktor.zabolotnii@lu.lv

Abstract
Hydrogen sulfide (H_2S) is a highly toxic and corrosive gas that demands reliable and continuous detection in both industrial and environmental settings. The accurate and timely identification of even trace concentrations of H_2S is critical for maintaining workplace safety, preventing health hazards, and ensuring effective environmental monitoring. Hydrogen sulfide can cause soil pollution, impacting agriculture by disrupting nutrient uptake in plants and affecting crop yields. While H_2S is toxic at high concentrations, it can also play a beneficial role as a signaling molecule in plants, particularly under stress.
Metal oxide semiconductors (MOS), such as tungsten trioxide (WO_3), have gained significant attention as promising gas-sensing materials owing to their intrinsic structural defects, high sensitivity, chemical stability, and the presence of oxygen vacancies, which collectively enhance their sensing performance.
In this study, the hydrothermal synthesis of hexagonal-phase WO_3 (h-WO_3) is presented and systematically characterized using X-ray diffraction (XRD), Raman spectroscopy, scanning electron microscopy (SEM), and transmission electron microscopy (TEM) to thoroughly examine its structural and morphological features in relation to its gas-sensing properties.
The synthesized material exhibited remarkable selectivity and sensitivity toward H_2S detection, primarily attributed to its porous architecture, large surface area, and favorable surface chemistry that facilitate efficient gas adsorption and reaction. These findings strongly emphasize the potential of h-WO_3 as a highly effective and reliable material for H_2S gas sensing applications in practical industrial, environmental and agriculture areas.

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