



Selective detection of hydrogen sulfide using copper oxide-doped tin oxide based thick film sensor array



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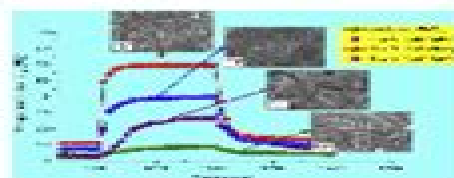
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HIGHLIGHTS

- Thick film sensor array has been developed by screen printing technique.
- SnO_2 doped with 3 wt% CuO is extremely sensitive (82%) to H_2S gas at 150°C .
- Above sensor shows high performance due to diminishing of the p–n junction.
- All sensors have switching like characteristics at low concentration of H_2S .

GRAPHICAL ABSTRACT



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ABSTRACT

In this work, copper oxide-doped (1, 3 and 5 wt%) tin oxide powders have been synthesized by sol–gel method and thick film sensor array has been developed by screen printing technique for the detection of H_2S gas. Powder X-ray diffraction pattern shows that the tin oxide (SnO_2)-doped with 3 wt% copper oxide (CuO) has smaller crystallite size in comparison to 0, 1 and 5 wt% CuO-doped SnO_2 . Furthermore, field emission scanning electron microscopy manifests the formation of porous film consisting of loosely interconnected small crystallites. The effect of various amounts of CuO dopant has been studied on the sensing properties of sensor array with respect to hydrogen sulfide (H_2S) gas. It is found that the SnO_2 doped with 3 wt% CuO is extremely sensitive (82%) to H_2S gas at 150°C , while it is almost insensitive to many other gases, i.e., hydrogen (H_2), carbon monoxide (CO), sulphur dioxide (SO_2) and liquefied petroleum gas (LPG). Moreover, at low concentration of gas, it shows fast recovery as compared to response time. Such high performance of 3 wt% CuO-doped SnO_2 thick film sensor is probably due to the diminishing of the p–n junction and the smallest crystallite size (11 nm) along with porous structure.

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1. Introduction

H_2S is a colourless, very poisonous, ignitable gas with the characteristic of foul odour of rotten eggs. It is mainly used for the

production of elemental sulphur and sulphuric acid, the manufacture of heavy water and other chemicals. For agriculture purpose, it is used as a disinfectant. It often results from the bacterial breakdown of organic matter in the absence of oxygen, such as in swamps and sewers. Other sources are craft paper mills, tanneries, coal mines, petroleum refineries etc. Since, it is a chemical asphyxiant, which affects human's nervous system and could cause an individual to lose consciousness even at a very low concentration. In addition, it may paralyze the lungs too. Considering the

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Copper Oxide Hydrogen Sulfide Detection

**William Crowell Bray, Ludwig
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Copper Oxide Hydrogen Sulfide Detection:

Copper(II)Oxide for Hydrogen Sulfide Detection Janosch Kneer,2015 Gas Sensing Fundamentals Claus-Dieter Kohl,Thorsten Wagner,2014-08-18 This volume which addresses various basic sensor principles covers micro gravimetric sensors semiconducting and nano tube sensors calorimetric sensors and optical sensors Furthermore the authors discuss recent developments in the related sensitive layers including new properties of nano structured metal oxide layers They provide in depth insights into the unique chemistry and signal generation of copper oxide in percolating sensors and present a variety of applications of functional polymers made possible by proper imprinting Highlights of the subjects covered include requirements for high temperature sensors carbon nano tube sensors new sensing model for nanostructured In₂O₃ bio mimetic approach for semiconductor sensor based systems optical readout for inorganic and organic semiconductor sensors concept of virtual multisensors to improve specificity and selectivity calorimetric sensors for hydrogen peroxide detection percolation effect based sensors to implement dosimeters imprinted polymer layers for bulk and surface acoustic wave sensors Industrial & Engineering Chemistry ,1925 Miners' Circular United States. Bureau of Mines,1946 **A Laboratory Manual of General Chemistry for Use in Colleges** William Crowell Bray,Wendell Mitchell Latimer,1921

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