ELSEVIER

**Applied Surface Science**
Volume 561, 30 September 2021, 150020


# Surface engineering of electrodeposited cuprous oxide ($Cu_2O$) thin films: Effect on hydrophobicity and LP gas sensing

Authors : K.N.D. Bandara, K.M.D.C. Jayathilaka, D.P. Dissanayake, J.K.D.S. Jayanetti

https://doi.org/10.1016/j.apsusc.2021.150020

Citation : Bandara, K.N.D., Jayathilaka, K.M.D.C., Dissanayake, D.P., & Jayanetti, J.K.D.S. (2021) Surface engineering of electrodeposited cuprous oxide (Cu2O) thin films: Effect on hydrophobicity and LP gas sensing, Applied Surface Science, 561, https://doi.org/10.1016/j.apsusc.2021.150020

## Abstract

*P*-type cuprous oxide thin films electrodeposited on a titanium substrate in a lactate bath was investigated for liquid petroleum gas (LPG) sensing. Contact angle measurements using water droplets revealed that the surfaces of the films become progressively hydrophobic with increasing deposition bath pH. The films deposited at pH = 10 were sensitive for LPG even at room temperature (30 °C). X-ray diffraction (XRD) and scanning electron microscopy (SEM) were performed to investigate the crystalline structure and the surface morphology of $Cu_2O$ films. According to the XRD patterns, the films had a preferred orientation along the (2 0 0) and (1 1 1) planes. The normalized intensity of (2 0 0) XRD peak increased with the deposition bath pH and reached its maximum value around pH = 11. It was also observed that the LPG sensitivity of the $Cu_2O$ films closely followed the normalized intensity of (200) peak. SEM images of $Cu_2O$ films showed the presence of well-defined crystallites with sharp edges. Atomic force microscopy (AFM) analysis showed that the surface roughness increased with deposition bath pH. Energy Dispersive X-ray analysis (EDAX) was used for compositional analysis of films and Mott - Schottky plots and spectral response measurements were carried out to confirm the *p*-type conductivity.

Keywords : Electrodeposition, Cuprous oxide, Wettability, Liquefied petroleum gas, Response time, Recovery time, Room temperature

# Graphical abstract