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GAS SENSING PROPERTIES OF EXCESS-IRON NI-ZN FERRITE

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ABSTRACT

The gas sensitivity to volatile organic compounds (benzene and ethanol) of nanostructured sol-gel auto-combustion synthesis derived non-stoichiometric cubic spinel type nickel zinc ferrite with formula $Ni_{0.3}Zn_{0.7}Fe_{2.1}O_{4+}$ is demonstrated for first time. Detailed synthesis steps and gas sensing measurement methodology were described. The sensor material was characterized by x-ray diffraction, scanning electron microscopy, mercury porosimetry and direct current resistance measurements. X-ray diffraction analysis confirms that sample formed the single phased cubic spinel structure and no peaks from impurity phases were detected. The scanning electron microscopy reveals nanosized grains less than 100 nm in diameter. Plots of resistance versus temperature show adsorbed water contribution to the conductance and an optimal stabilization temperature of the gas sensor material. Overall, sensors were tested at temperature interval from 200 ^{o}C to 400 ^{o}C in order to identify operating temperature of the material. The response-recovery characteristics and the correlation between gas concentrations and response of sensor material also were performed. Resistance drops quickly when gas is introduced into testing atmosphere indicating response time ~1 min and recovery ~2 min. The $Ni_{0.3}Zn_{0.7}Fe_{2.1}O_{4+}$ sensor material demonstrates n-type conductivity with potential application in gas sensor area by showing sufficient sensitivity either to benzene and ethanol with higher response for ethanol.