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Preparation of highly sensitive Cr doped ZnFe2O4 fiber-like sensors for selective acetone detection

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Semiconducting metal oxides are widely recognized as key sensing materials that are used for gas detection in several fields. In particular, zinc ferrite has attracted growing attention because of its sensitivity to volatile organic compounds, making it a potential sensing material for food spoilage detection/monitoring [1]. However, the high operating temperatures and poor selectivity hinder practical application. This work aims to overcome these challenges by using Cr dopant to reduce the operating temperature and enhance the response variance for accurate gas classification using principal component analysis. A combustion method was used to synthesize Cr-doped ZnFe2O4 (0.0, 0.5, 1.0, and 1.5 Cr mol%) fiber-like products. XRD and HRTEM were used to analyse microstructure and morphology of the products. TEM confirmed that the morphology of the synthesized products possesses fiber-like structures. Optical properties of the products were studied using PL and XPS was used for surface composition analysis. The gas sensing results showed that the sensor based on 1.0% Cr-doped ZnFe2O4 had an enhanced response of 283-90 ppm acetone at a low operating temperature of 90 ℃. Moreover, the sensor based on ZnFe2O4 doped with 1.0% Cr can be used as a single array sensor for gas classification. The improved sensing properties are attributed to structural defects and proper gas diffusion.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

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