Selectivity control of Ni-doped copper oxide at high operating temperatures

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Abstract. Gas sensors are of major importance in today's industrial, chemical, agricultural, energy and household fields, and their development for general consumer use is an area of growing interest [1, 2].

This study explores the development and hydrogen sensing performance of CuO nanostructures synthesized via a cost-effective chemical solution method. The nanostructures, composed of copper oxide granules uniformly coated with nickel nanoparticles, were deposited on a glass substrate and thermally treated using rapid thermal annealing (RTA) to minimize defects.

Figure 1 shows the response to several investigated gases, where a high sensitivity to hydrogen can be observed, with responses of 60-70% at high temperatures of 300°C and 350°C. The uniform deposition of Ni on CuO played a critical role in enhancing both sensitivity and selectivity towards hydrogen, while minimizing interference from other gases such as acetone, methane, and ammonia.

The sensor also demonstrated rapid response and recovery times, further confirming its potential for efficient hydrogen detection. These findings suggest that CuO nanostructures offer a promising, cost-effective solution for hydrogen sensing applications, particularly in safety-critical environments where hydrogen leaks need to be rapidly detected.

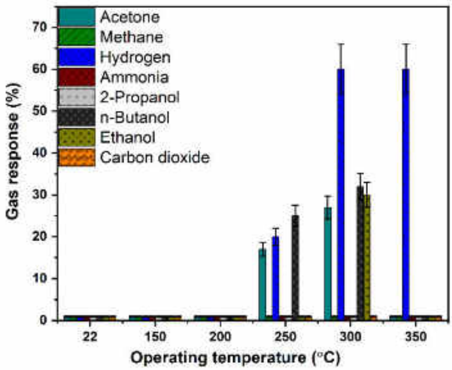

Figure 1. The response of CuO:Ni nanostructures to different gases with concentration of 100 ppm at the different operating temperatures.

The following formula was used to determine the sensor signal [3]:

$$S = \frac{R_{gas} - R_{air}}{R_{air}} \times 100\% \quad (1)$$

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