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Synthesis and characterization of highly selective and sensitive Sn/SnO₂/N-doped carbon nanocomposite (Sn/SnO₂@NGC) for sensing toxic NH₃ gas

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Abstract

In the present study, a facial synthesis of Sn/SnO₂ nanoparticles embedded in nitrogen doped carbon based nanocomposites has been disclosed which was used as a fast and high-performance NH₃ gas sensor. The prepared nanocomposite was characterized by various analytical technique including FTIR, TGA/DTA, Raman, XRD, FESEM, TEM/HRTEM and XPS. The presence of both Sn and SnO₂ nanoparticles in carbon matrix are supported by FTIR, Raman and XRD. The XRD analysis showed the tetragonal crystal phase of SnO₂ nanoparticles, and the BET results revealed 148.9 m² g⁻¹ surface area of the nanocomposite. Furthermore, SEM image showed that Sn and SnO₂ nanoparticles were well dispersed in the nitrogen doped carbon matrix. The fabricated sensor was characterized against various concentration of NH₃ and the results indicated that the prepared sensor showed excellent responses at 65^oC working temperature, with 300 ppm concentration of NH₃ and the sensitivity was observed 172.70. Additionally, the fabricated sensor also showed quick response and the recovery time of 60 s and 55 s, respectively. The fabricated sensor with its quick response and recovery time, good repeatability, excellent selectivity, and slight humidity effects has the potential and could be used as NH₃ sensor on industrial scale.

Key words: Nanocomposite; Gas sensor; NH₃; Carbon matrix

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