

Highly Sensitive Chemiresistive H₂S Gas Sensor Based on Graphene decorated with Ag Nanoparticles and Charged Impurities

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Abstract

We report a highly sensitive and selective H₂S gas sensor based on graphene decorated with Ag nanoparticles and charged impurities fabricated using a simple wet chemical method. Doping on as-grown chemical vapor deposited graphene was achieved by immersion in an aqueous solution of AgNO₃/Fe(NO₃)₃ for 4 min followed by the decoration with adsorbed AgNPs and charged impurities. The AgNPs utilized in this process were formed by the reduction of Ag⁺ ions, since the Ag⁺/Ag⁰ reduction potential is higher than that of Fe³⁺/Fe⁰.

This above treatment changed the electronic properties of graphene, achieving a dramatic resistivity change in the presence of H₂S level monitoring at ambient temperature with an immediate response.

References

- [1] O. Ovsianytskyi et al, Sens. Actuators B, 257(2018) 278-285.
- [2] M. MalekAlaiea et al, Mater. Sci. Semicond. Process. 38(2015) 93-100.
- [3] Z. Song et al, Sens. Actuators B, 249(2017) 632-638.
- [4] A. Fattah IEEE Sens. J. 14(2014) 632-638.
- [5] A. H. Reshak, S. Auluck, J. Appl. Phys. 116(2014) 103702
- [6] Y.-H. Zhang et al, Comput. Mater. Sci. 69(2013) 222-228.

Figures

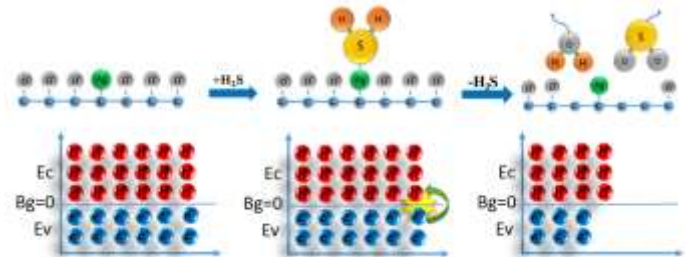


Figure 1: Schematic representation of (A) H₂S sensing by graphene decorated with AgNO₃ and (B) dissociation of H₂S adsorbed on the surface of decorated graphene. Ec: conduction band energy, Ev: valence band energy, Bg: band gap

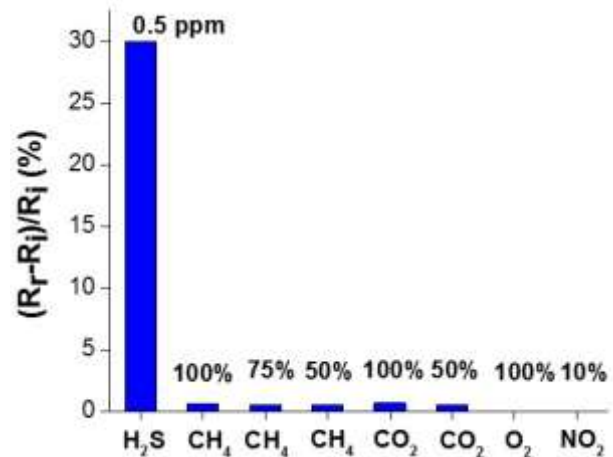


Figure 2: Relative response of the developed graphene sensors to various gases