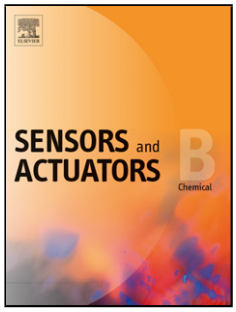

Title: Highly sensitive chemiresistive H_2S gas sensor based on graphene decorated with Ag nanoparticles and charged impurities

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<DOCHEAD>Research paper

<AT>Highly sensitive chemiresistive H_2S gas sensor based on graphene decorated with Ag nanoparticles and charged impurities

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<ABS-Head><ABS-HEAD>Graphical abstract
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<ABS-P><xps:span class="xps_Image">fx1</xps:span>
<ABS-HEAD>Highlights► Chemiresistive H_2S sensor based on Ag nanoparticles doped-graphene was fabricated. ► Doping was performed in aqueous $AgNO_3$ and $Fe(NO_3)_3$ by a simple wet-chemical method. ► The produced graphene sensor can detect ~100 ppb of H_2S gas within 6 min. ► The fabricated sensor exhibits excellent selectivity towards H_2S gas.
<ABS-HEAD>ABSTRACT

<ABS-P> Herein, we report a highly sensitive and selective H_2S gas sensor based on graphene decorated with Ag nanoparticles (AgNPs) 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 $AgNO_3/Fe(NO_3)_3$ 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^+/Ag^0 reduction potential is higher than that of Fe^{3+}/Fe^0.
<ABS-P>The above treatment changed the electronic properties of graphene, achieving a dramatic resistivity change in the presence of H_2S gas by generating surface sites for its adsorption and dissociation and thus allowing real time H_2S level monitoring at ambient temperature with an immediate response.
<ABS-P>Doped graphene was demonstrated to selectively and repeatedly sense H_2S gas within six minutes, with the limit of detection being below 100 ppb. The corresponding mechanism is believed to feature a charge carrier density change of graphene to adsorbate charge transfer, with the sensor surface trapping or releasing electrons upon exposure to H_2S gas.