GRAPHENE/BN VAN DER WAALS HETEROSTRUCTURES FOR ENHANCED TOXIC GAS SENSING

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Graphene is well-known for its exceptional electrical conductivity, high surface area, and carrier mobility, making it an ideal material for gas sensors. Combining graphene with highly thermally stable and oxidation-resistant boron nitride (BN) to create van der Waals (vdW) heterostructures (by stacking BN on graphene) holds significant potential for enhancing graphene's sensing capabilities. Pulsed laser deposition (PLD), a robust technique renowned for its precise control over film thickness and stoichiometric deposition, has been previously used for growing thin film oxide layers on graphene [1,2].

In this study, we developed a heterostructure by depositing ultrathin BN (~1 nm) on graphene via PLD, which exhibited approximately a threefold increase in sensitivity to environmentally pollutant NO_2 and O_3 gases compared to pristine CVD graphene (Fig. 1a). The Raman spectra of the graphene after BN growth (Fig. 1b) showed the emergence of defect-related D (at ~1350 cm^{-1}) and D' (at ~1625 cm^{-1}) peaks, indicating that the PLD of BN introduced defects, without significantly deteriorating the graphene's transducer performance.

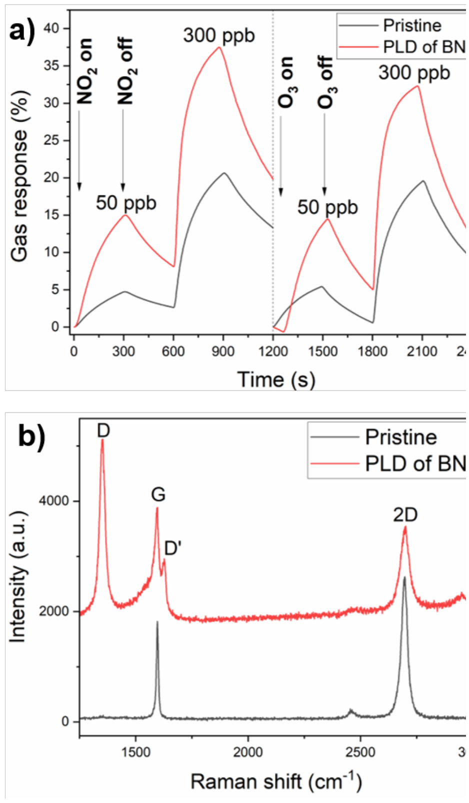

Fig.1 a) Temporal responses of pristine and BN-grown graphene to NO_2 and O_3 gases. The gas responses were measured in air at room temperature under UV (365 nm) illumination with a relative humidity of 40%. b) Raman spectra of pristine and BN-grown graphene sensors.

References

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