GRAPHENE-BASED GAS SENSORS MODIFIED BY PULSED LASER DEPOSITION FOR NO_2 AND NH_3 DETECTION

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Graphene, due to its flat 2D structure (high surface-to-volume ratio) and electrical properties (high carrier mobility and low electrical noise) has attracted a lot of attention for gas sensor applications. We recently demonstrated that modification of graphene and introduction of suitable defects can significantly improve its sensitivity and selectivity to different gases. Pulsed laser deposition (PLD) of ultrathin ZrO_2, Ag or V_2O_5 layers on top of graphene was used to enhance its performance as a sensing material.

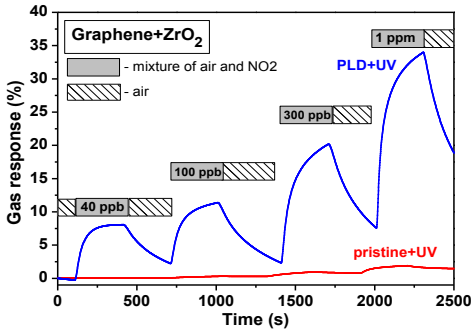

Fig.1 Responses of ZrO_2-modified graphene to various NO_2 concentrations in air under UV illumination.

Graphene in this work was grown on copper foil in a hot-wall quartz tube CVD reactor and later transferred onto Si/SiO_2 substrates. According to Raman spectroscopy, defects were introduced in graphene only after functionalisation by PLD. Conductometric responses of graphene-based gas sensors to the polluting NO_2 gas in air were measured with different gas concentrations in the range between 40 ppb and 1 ppm (Fig. 1).

The response of modified graphene gas sensors was improved significantly (up to two orders) in comparison with pristine graphene. Different materials used in PLD process also allowed performance diversification: ZrO_2-modified samples had amplified responses but required UV-light illumination for signal recovery after exposure to NO_2 while in the case of Ag the responses were reversible without UV light. In the case of V_2O_5 it has been demonstrated that the modified sensor became more sensitive towards reducing pollutant NH_3, providing partial selectivity.

References

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