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UV assisted NH_3 Gas Sensor based on Ternary Reduced Graphene Oxide/TiO_2/Au composites at Room Temperature

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Abstract：

Ammonia gas is a hazardous gas species, which will impose great threat on human health and ecological environment. Thus, it is of great importance to selectively and sensitively detect NH_3 gas at low level. In this report, we adopt hydrothermal method to prepare tenary composites of reduced graphene oxide nanosheets (rGO), TiO_2 nanotubes and Au nanoparticles, and then probe NH_3 gas spanning from 1 ppm to 10 ppm under UV illumination (365 nm) at room temperature (25 ^oC). Within the composites, rGO nanosheets serve as a template to provide attachment sites of TiO_2 and Au, and supress their aggragation via the steric hindrance effect. TiO_2 nanotubes as a typical UV light-sensitive material contribute a mass of photogenerated electron-hole pairs, which will well react with exposed NH_3 molecules. Meanwhile, incorporation of Au nanoparticles could significantly increase the sorption sites due to the spillover effect. As expected, the as-prepared sensors enable a room-temperature detection response of 10% toward 1 ppm NH_3 under UV illumination as well as an excellent selectivity, repeatability and long-term stability, which is far incapable for other prepared ones based on random binary composites or individual component. In brief, the ternary sensors have exhibited huge superiority in trace-level NH_3 detection in terms of low-power consumption and high sensitivity.

Key words: NH_3 gas sensor, reduce graphene oxide, TiO_2, Au nanoparticle, UV illumination