Supramolecular Functionalized Pristine Graphene Utilizing A Bio-compatible Stabilizer Towards Ultra-sensitive Ammonia Detection

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Abstract:

Recently, Graphene has attracted intensive attention in the gas sensing field due to its high electrical conductivity as well as large specific surface areas. Lots of graphene-based gas sensor have been reported with excellent gas sensing performance. However, the sensing element materials for most of the above sensors are actually consisted of reduced graphene oxide (GO) derivative rather than pristine graphene, like rGO, rGO/metal particle, rGO/polymers etc. Complex chemical oxidation and reduction are usually involved for the preparation of reduced graphene oxide derivatives. Even though there are some pristine graphene-based gas sensor synthesizing with the approaches of chemical vapor deposition (CVD) or mechanical cleavage, the high cost of the set-up or the low productivity cannot decrease the cost of the practical sensors.

In this work, we develop pristine graphene-based gas sensors utilizing flavin monocleotide sodium salt (FMNS) towards ultra-sensitive ammonia detection. The sensor has 3% response upon exposure to 10 ppm NH_3 and a limit of detection of 1.6 ppm at room temperature and shows a good recovery. Raman, UV-vis, FT-IR spectra, as well as SEM measurements are employed to characterized the quality of the graphene flakes, indicating a good structural quality of graphene with few defects. The effects of the concentration of graphene dispersion functionalized by FMNS on the sensing performance towards ammonia sensing were also investigated. The process is very mild, environmentally friendly, and low cost. We believe this work may pave a path to design high performance gas sensor with low cost and boost the application of graphene for sensing.