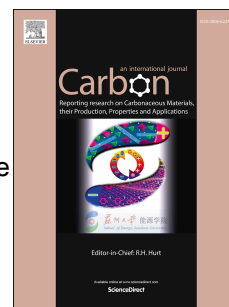


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Flexible chemical sensors based on hybrid layer consisting of molybdenum disulphide nanosheets and carbon nanotubes

Sungho Kim^{a, b}, Jin-Kyu Han^a, Min-A Kang^a, Wooseok Song^a, Sung Myung^{a, *}, Sang-Woo Kim^b, Sun Sook Lee^a, Jongsun Lim^a, Ki-Seok An^a

A facile synthesis method was developed for preparing hybrid 2-dimensional (2D) films, based on large-scale molybdenum disulfide (MoS_2) nanosheets and single-walled carbon nanotubes (SWCNTs), for flexible sensors. Here, 1-dimensional (1D) SWCNTs were combined with MoS_2 nanosheets during the MoS_2 synthesis process for improving the flexibility and stability of the 2D MoS_2 nanosheet. Uniform MoS_2 nanosheets were successfully synthesized via chemical vapor deposition (CVD) using a porphyrin-type organic promoter. This study demonstrates the high performance and enhanced sensitivity of the chemical gas sensors that were fabricated using hybrid MoS_2 -SWCNT layers; the enhancement is due to the sensitive gas adsorption by SWCNTs in the MoS_2 nanosheets. In addition, the hybrid MoS_2 -SWCNT films, transferred on a flexible polyethylene terephthalate (PET) substrate, were employed for the analysis of physical properties of chemical sensors as a function of the number of bending cycles. The hybrid MoS_2 -SWCNT-based sensors showed stable sensing performance after 10^5 bending cycles, whereas the resistance of MoS_2 -based sensors increased to approximately 300 % under the same bending process.

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