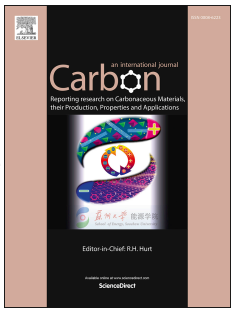
Accepted Manuscript



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

Sungho Kim, Jinkyu Han, Min-A. Kang, Wooseok Song, Sung Myung, Sang-Woo Kim, Sun Sook Lee, Jongsun Lim, Ki-Seok An

PII: S0008-6223(17)31299-X

DOI: 10.1016/j.carbon.2017.12.065

Reference: CARBON 12695

To appear in: *Carbon*

Received Date: 21 September 2017

Revised Date: 25 November 2017

Accepted Date: 17 December 2017

Please cite this article as: S. Kim, J. Han, M.-A. Kang, W. Song, S. Myung, S.-W. Kim, S.S. Lee, J. Lim, K.-S. An, Flexible chemical sensors based on hybrid layer consisting of molybdenum disulphide nanosheets and carbon nanotubes, *Carbon* (2018), doi: 10.1016/j.carbon.2017.12.065.

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.

*Corresponding author. Tel.: +82 42 860 7350; fax: +82 42 861 4151.

E-mail address: msung@krict.re.kr (Sung Myung)