DOI 10.5162/IMCS2018/NG.3

Room Temperature High Performance NH_3 Sensor：In Situ Growth Polyaniline Nanofibers Decorated by SnO_2 on Flexible PET Substrate

*Siqi Li, Fangmeng Liu, Geyu Lu**
State Key Laboratory on Integrated Optoelectronics, Key Laboratory of gas sensors, Jilin Province and College of Electronic Science and Engineering, Jilin University, 2699 Qianjin Street, Changchun 130012, People's Republic of China
Corresponding authors: liufangmeng@jlu.edu.cn, lugy@jlu.edu.cn.

Abstract:
The polyaniline (PANI) nanofibers based chemical sensors assembled on flexible PET substrate are the current research hotspot, because of its low cost, flexible design and room temperature detection. In order to further enhance the gas sensing properties, the preparation of hybrid materials with semiconducting metal oxides (SMOs) decorate PANI to the formation of heterojunction structure is an effective strategy. Herein, we presented PANI decorated by SnO_2 (PAS) hybrid by in-situ chemical oxidative polymerization method. The materials are assembled on the flexible polyethylene terephthalate (PET) substrate with no extra electrode to fabricate the high performance room temperature NH_3 sensor. The gas sensing performance of the assembled sensors indicates that the sensor based on PAS10 exhibits the highest response value at about 15 to 100 ppm NH_3 at room temperature, which is 5 times higher than that of pure PANI. Additionally, the developed sensor also displays wonderful selectivity against other gases and good humidity resistance. The excellent sensing performance for the device based on PAS10 and flexible PET substrate is expected to hold great promise for developing wearable flexible electronics.

Key words: Room temperature, NH_3 sensor, PANI, PAS hybrid, Flexible PET substrate.

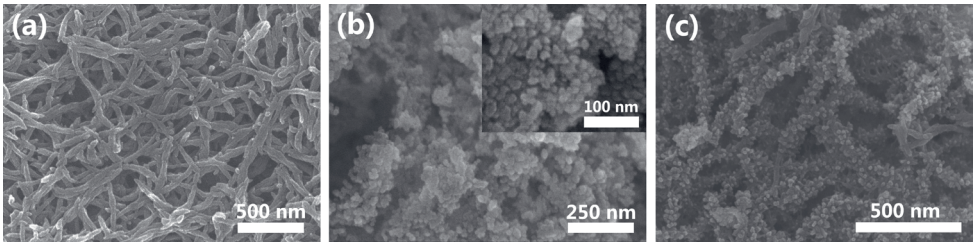

Fig. 1. FESEM images of (a) polyaniline nanofibers; (b) SnO_2 nanoparticles; (c) PAS50 hybrid.

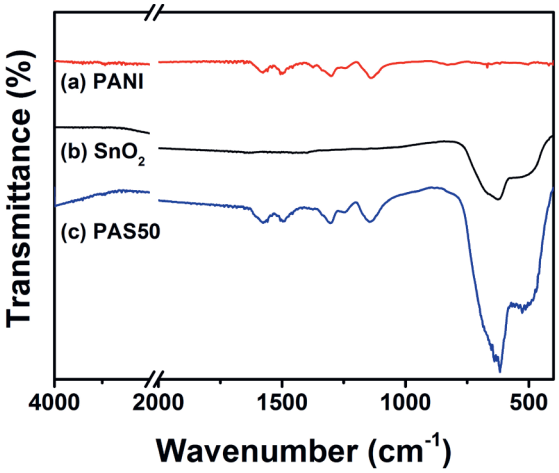

Fig.2. FTIR spectra of (a) PANI; (b) SnO_2; (c) PAS50 hybrid.

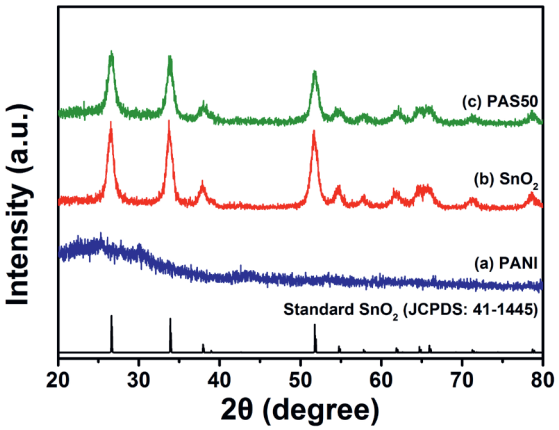

Fig.3. XRD patterns of (a) PANI; (b) SnO_2; (c) PAS50 hybrid

References

[1] S. L. Bai, Y. H. Zhao, J. H. Sun, Z. F. Tong, R. X. Luo, D. Q. Li, A. F. Chen, Preparation of conducting films based on α -MoO_3/PANI hybrids and their sensing properties to triethylamine at room temperature, Sensors and Actuators B: Chemical 239, 131–138 (2017); doi: 10.1016/j.snb.2016.07.174.

[2] S. Q. Li, P. F. Lin, L. P. Zhao, F. M. Liu, G. Y. Lu, The room temperature gas sensor based on Polyaniline@flower-like WO_3 nanocomposites and flexible PET substrate for NH_3 detection, *Sensors and Actuators B: Chemical* 259, 505-513 (2018); doi: 10.1016/j.snb.2017.11.081.

[3] Y. L. Guo, T. Wang, F. H. Chen, P. B. Wan, X. D. Chen, Hierarchical graphene–polyaniline nanocomposite films for high-performance flexible electronic gas sensors, Nanoscale 8, 12073-12080 (2016); doi: 10.1039/c6nr02540d.

[4] L. Wang, H. Huang, S. Xiao, D. Cai, Y. Liu, B. Liu, Enhanced sensitivity and stability of room-temperature NH_3 sensors using core-shell CeO_2 nanoparticles@cross-linked PANI with p-n heterojunctions, Acs Applied Materials & Interfaces 6, 14131–14140 (2014); doi: 10.1021/am503286h.

[5] S. Bai, Y. Tian, M. Cui, J. Sun, Y. Tian, R. Luo, Polyaniline@SnO_2 heterojunction loading on flexible PET thin film for detection of NH_3 at room temperature, Sensors and Actuators B: Chemical 226, 540–547 (2016); doi: 10.1016/j.snb.2015.12.007.

[6] H. Hien, T. Giang, N. Hieu, T. Trung, C. Tuan, Elaboration of Pd-nanoparticledecorated polyaniline films for room temperature NH_3 gas sensors, Sensors and Actuators B: Chemical 249, 348–356 (2017); doi: 10.1016/j.snb.2017.04.115.

[7] Y. X. Qin, Z. Cui, T. Y. Zhang, D. Liu, Polypyrrole shell (nanoparticles)-functionalized silicon nanowires array with enhanced NH_3-sensing response, Sensors and Actuators B: Chemical 258, 246–254 (2018); doi: 10.1016/j.snb.2017.11.089.