P3HT/PMMA Fibers Fabricated by Electrospinning Technique for High Sensitivity Volatile Organic Compounds Sensor

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1. Introduction
Volatile organic compounds (VOCs) sensors are the imperative technology of modern life for environmental monitoring. In this study, we demonstrated a VOCs sensor chip adopting the proposed methodology that the optical property of poly(3-hexylthiophene)(P3HT)/poly(methyl methacrylate)(PMMA) blend is sensitive to VOCs vapor due to morphological evolution and hence can be served as an indication of the presence of VOCs.[1] Various VOCs, including toluene, chlorobenzene and acetone, were used to test the sensitivity of our P3HT/PMMA VOCs sensing chip[2-3]. The P3HT/PMMA served as a representative blend, and the sensitivity of the P3HT/PMMA blend was optimized with respect to P3HT/PMMA blending ratio, and blend concentration. The low cost and high sensitivity VOCs sensing chip developed in this study significantly extends the current VOCs sensing technology and can be extensively used to effectively prevent humans and the environment from potential damages of VOCs.

2. General Instructions
For the fabrication of VOCs sensing chips, the PMMA and various concentration P3HT were dissolved in chlorobenzene with continuous stirring for 48 h, respectively. Then, the P3HT solution was added to the stirred solution of PMMA in chlorobenzene. During the electrospinning process, the constant flow rate was fixed at 1.0 m/lh; the tip-to-collector distance was fixed at 7.0 cm and applied high-voltage 15.0 kV. The rotational speed of the metallic collector was 80 rpm. The extinction spectra of the P3HT/PMMA sensing chip exposed to various VOCs, including toluene, chlorobenzene and acetone, were determined to test the sensitivity of the sensor chip at 560, 600 and 1020 nm. The P3HT/PMMA served as a sensing chip exposed to various VOCs, in- 

The extinction spectra of P3HT/PMMA sensor chip exposed various VOCs for different time are shown in (Fig. 1(b)-(d)). These VOCs, including toluene, chlorobenzene and acetone, were chosen to test the applicability of the sensor, and the results reveal high performance. In addition, the P3HT/PMMA sensor chip exhibited the highest sensitivity for exposing chlorobenzene.

Figure 1 Extinction spectra of P3HT/PMMA sensing chip (a) before and after chlorobenzene vapor exposure for 2 h (b) exposed various VOCs for different time.

3. Conclusions
The VOCs sensing materials consisted of P3HT/PMMA blending were prepared successfully by electrospinning process in this study. A series of VOCs, e.g. acetone, toluene and chlorobenzene were chosen to test the sensitivity of P3HT/PMMA fibrous film. The P3HT/PMMA fibrous film can effective detect the lower explosive limit of VOCs, and it even can achieve the detection limit of acetone, toluene at 500 ppm. This low-cost P3HT/PMMA fibrous film developed in the present work extends the current VOCs sensing technology. It can be extensively used to protect humans and the environment from VOCs potential risks.

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References