Sensing characteristics of polypyrrole-based methanol sensors preparedbyin-situ vapor state polymerization

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Conducting PPy/PVA composite and pure PPy gas sensors were prepared by in-situ vaporstate polymerization method in a vaporization chamber under N2 condition, by exposing the pre-coated electrode with PVA/FeCl3 to distilled pyrrole monomer. The various electrical sensing behaviors of both types of sensors were systematically investigated by a flow measuring system including mass flow controller (MFC) and bubbling bottle. The FT-Raman spectroscopy of vapor state polymerized PPy was identical to that of chemically polymerized PPy, confirming the same chemical structure. Both types of sensors had positive sensitivity when exposed to methanol gas. The sensitivity varied linearly with gas concentration in the range of 50ppm to 1059ppm. The detection limit of PPy/PVA sensor was believed to be as low as 10ppm. The sensitivity of PPy/PVA composite sensor was higher than that of pure PPy sensor. Both the response time and recovery time of PPy/PVA composite sensors were longer than those of pure PPy sensors. The thickness of the sensing film affected the sensitivity this way that the sensor having thinner film had higher sensitivity, indicating that the resistance of polymer film involved in the sensing behavior was bulk resistance rather than surface resistance. The reproducibility of PPy/PVA composite sensor was excellent during eight on-off cycles by switching between N2 and 3000ppm methanol gas. The sensitivity of PPy/PVA composite sensor was only maintained for two weeks, while the sensitivity of pure PPy sensor was maintained over two months.