

**PRODUCTION OF MULTIWALL CARBON NANOTUBE
FOR ALCOHOL SENSOR APPLICATION**

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DECLARATION

I hereby declare that the work reported in this thesis is my own unless specified and duly
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ABSTRACT

Multiwall carbon nanotube/polyethylene oxide (PEO), multiwall carbon nanotube/polyvinyl alcohol(PVA) and multiwall carbon nanotube/ polyvinyl alcohol(PVA)/zinc oxide(ZnO) have been tested as chemical sensors and detailed study on the effect of different gas concentration and material properties on gas sensitivity is presented. Initial composites were prepared by a simple solution casting and characterized by x-ray diffraction for ZnO, Fourier transform infra-red spectroscopy (FTIR) and scanning electron microscopy (SEM) to demonstrate crystallite size of ZnO, the morphology and surface area respectively. On the other hand, MWCNT/PEO , MWCNT/PVA , MWCNT/PVA/ZnO were prepared with different loading MWCNT and ZnO. The chemical sensing properties of the composites were investigated by exposure to methanol vapor with different concentration (1.7, 3.3, 5,8.3 and 16.7vol% in water). The sensing experiment proved that the sensitivity of the composites increase due to amount of CNT and the highest value to the sensitivity was at composites with ZnO. It was discovered that for all composite systems, the highest sensitivity was recorded at moderate methanol concentrations in water of about 5%. For MWCNT/PVA composite, sensitivity increased with MWCNT loading as expected. The highest recorded was about 250% for 5% MWCNT loading detecting 5% methanol in water. Similar result was obtained with MWCNT/PVA/ZnO composites with 1% MWCNT and 3% ZnO, indicating the significant role of ZnO in methanol detection.

ABSTRAK

Tiubnano Karbon Polietilena Oksida (Multiwall Carbon Nanotube Polyethylene Oxide) Berbilang Dinding, Tiubnano Karbon Alkohol Polivinil (Multiwall Carbon Nanotube Polyvinyl Alcohol) Berbilang Dinding dan Tiubnano Karbon Alkohol Polivinil (Multiwall Carbon Nanotube Polyvinyl Alcohol)/Zink Oksida (ZnO) Berbilang Dinding telah diuji sebagai pengesanan-pengesanan kimia dan kajian terperinci tentang kepekaan gas menggunakan kepekatan gas berbeza dan ciri-ciri bahan yang berbeza telah dibentangkan. Komposit awal telah yang disediakan dengan menggunakan larutan mudah yang kemudiannya dikaji menggunakan Belauan Sinar-X, (XRD), Spektroskopi Inframerah Jelmaan Fourier (FTIR) dan Mikroskop Imbasan Elektron (SEM) yang mana bertujuan untuk menunjukkan saiz kristalit, morfologi dan luas permukaan ZnO. Pada masa yang sama, MWCNT / PEO, MWCNT / PVA dan MWCNT / PVA / ZnO telah disediakan dengan muatan MWCNT dan ZNO yang berbeza. Ciri-ciri penderiaan sesuatu komposit kimia telah disiasat dengan melakukan pendedahan kepada wap metanol dengan kepekatan methanol yang berbeza (1.7, 3.3, 5, 8.3 dan 16.7vol% di dalam air). Eksperimen penderiaan membuktikan bahawa kepekaan sesuatu komposit kimia bertambah dengan pertambahan jumlah CNT dan nilai tertinggi bagi kepekaan berada di dalam komposit yang mengandungi ZnO. Penemuan membuktikan bahawa untuk semua sistem komposit tersebut, kepekaan paling tinggi telah dicatatkan pada kepekatan metanol yang sederhana iaitu pada lebih kurang 5% methanol di dalam air. Untuk komposit MWCNT / PVA, kepekaan bertambah dengan peningkatan muatan MWCNT seperti yang telah dijangkakan. Rekod kepekaan yang tertinggi ialah kira-kira 250% untuk 5% muatan MWCNT yang mana ia mengesan 5% metanol di dalam air. Kajian serupa telah diperolehi pada komposit MWCNT / PVA / ZnO dengan kandungan 1% MWCNT dan 3% ZnO, menunjukkan peranan penting ZnO dalam pengesanan metanol.

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