UNIVERSITI TEKNOLOGI MARA

STUDY ON THE EFFECTS OF CARBON NANOTUBES IN PMMA-BASED NANOCOMPOSITE THIN FILMS

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Thesis submitted in fulfillment of the requirements
for the degree of
Master of Science

Faculty of Applied Sciences

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Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This topic has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

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ABSTRACT

Carbon nanotubes (CNTs) were produced via thermal chemical vapor deposition (TCVD) at varied temperature from 700 °C up to 900 °C. Studies on the effect of different precursors and type of catalysts towards the CNTs production were done. Two types of palm-based precursors which is palm DHSA and palm oil along with monometallic, bimetallic and trimetallic catalysts were used to study the effect of growth production of CNTs. Characterization was done by using field emission scanning electron microscope (FESEM) and transmission electron microscope (TEM). Both SEM and TEM studies had confirmed that different precursors and catalysts provide different graphitization and yield of the CNTs produced. Moreover, palm oil produced nanotubes with less entangle structure in which give better condition for further processing in nanocomposite. For monometallic catalyst, nickel (Ni) has shown the highest yield with good graphitization. As such, Ni was chosen to be added in bimetallic and trimetallic catalysts. Co/Ni and Fe/Ni/Mn catalyst were observed to produce good graphitization and highest yield of MWCNTs. As such, MWCNTs produced from palm oil grown over Fe/Ni/Mn trimetallic catalyst was used for further study. The produced MWCNTs were functionalized by bromine treatment before it was further used in PMMA/MWCNTs nanocomposite preparation. Characterization was done using Raman spectroscopy, thermogravimetric analysis (TGA) and X-ray diffraction (XRD) which confirmed the functionalization of bromine on MWCNTs surfaces. Bromine treatment was employed to improve the electrical properties of PMMA/MWCNTs nanocomposite thin films. As such, the electrical properties of nanocomposite were increased with increase of MWCNTs loading compared to the untreated MWCNTs. The optical band gap of nanocomposite was studied using UV-Visible spectroscopy. The dispersion behavior of MWCNTs into PMMA was investigated by SEM and Fourier Transform Infrared (FTIR) spectroscopy and confirmed that high dispersibility was achieved when MWCNTs loading at 3.0 wt. %.

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