

EFFECT OF SEPIOLITE CONTENT ON MECHANICAL, THERMAL AND  
FLAMMABILITY PROPERTIES OF ETHYLENE VINYL ACETATE  
NANOCOMPOSITE

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*I lovingly dedicate this thesis to my wife Zhaleh and my Mother and Father who supported me each step of the way.*

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## ABSTRACT

Polymer/clay nanocomposites are a new class of composite materials consisting of a polymer matrix with dispersed clay nanoparticles. Ethylene vinyl acetate (EVA)/Sepiolite and EVA/modified Sepiolite (M-Sepiolite) nanocomposites were prepared by melt extrusion using a counter-rotating twin-screw extruder followed by injection molding in order to examine the mechanical, morphological, thermal and flammability properties of the nanocomposites. Sepiolite was modified with silane treatment (M-Sepiolite). Sepiolite content was various in EVA with 1, 3, 5 and 7 wt%. The mechanical properties of EVA/Sepiolite and EVA/M-sepiolite nanocomposites were studied through tensile. Scanning electron microscopy (SEM) was used to investigate the phase morphology of nanocomposites. The thermal properties were determined using Thermogravimetric analysis (TGA) and flame retardancy of nanocomposites was conducted by characterization for limiting oxygen index. The mechanical, thermal and flame retardancy properties of EVA / Sepiolite nanocomposite increased with the increase sepiolite content due to good dispersion and well interface interaction between Sepiolite and EVA. The mechanical, thermal and flame retardancy properties the EVA/M-Sepiolite nanocomposite was better than the mechanical, thermal and flame retardancy properties of EVA/Sepiolite nanocomposite, where the modification of Sepiolite caused extremely good interface interaction, as well as good dispersion and better adhesion between Sepiolite and polymer matrix.

## ABSTRAK

Nanokomposit polimer/tanah liat adalah komposit kelas baru, terdiri daripada matriks polimer yang terisi dengan zarah tanah liat yang bersaiz nano. Nanokomposit etilena vinil asetat (EVA) and EVA/sepiolite yang telah diubahsuai (M-Sepiolite) disediakan melalui proses pengekrudan lebur dengan menggunakan ekstruder skru berkembar yang berputar bertentangan arah, diikuti dengan mesin pengacuanan untuk mengkaji sifat mekanik, morfologi, termal dan sifat untuk terbakar bagi komposit nano. Sepiolite telah diubahsuai dengan rawatan menggunakan silane (M-Sepiolite). Kandungan sepiolite di dalam EVA telah divariasikan kepada 1,3,4,5 dan 7 wt.%. Sifat mekanikal EVA/sepiolite dan komposit nano EVA/M-sepiolite telah dikaji menggunakan mesin tegangan dan mesin penguji kekerasan. Mesin pengimbas electron (SEM) telah digunakan untuk mengkaji morfologi komposit nano. Sifat termal telah ditentukan dengan menggunakan analisis termogravimetri, dan ujian rintangan untuk terbakar telah dijalankan dengan pencirian untuk indeks oksigen yang terhad. Sifat mekanikal, termal dan rintangan untuk terbakar komposit nano/Sepiolite telah meningkat dengan penambahan kandungan sepiolite disebabkan oleh penyebaran dan interaksi yang baik antara sepiolite dan EVA. Sifat mekanikal, termal dan kerintangan untuk terbakar bagi komposit nano EVA/M-Sepiolite adalah lebih baik daripada sifat-sifat yang dipunyai oleh komposit nano EVA/Sepiolite, di mana sepiolite yang telah diubahsuai menghasilkan interaksi yang amat baik, begitu juga dengan penyebaran antara sepiolite dan matriks polimer.