ADVANCES IN COMPOSITE MATERIALS

Iskandar Idris Yaacob
Md Abdul Maleque
Zahurin Halim

IIUM Press
Iskandar Idris Yaacob, Md Abdul Maleque & Zahurin Halim: Advances in Composite Materials.

ISBN: 978-967-418-231-1

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)
# Table of Content

**Chapter 1**  
A Critical Review of Metal Matrix Composite Brake Rotor  
*Md Abdul Maleque*  
1

**Chapter 2**  
Technology of Moulding for Composite Auto Brake Rotor  
*Md Abdul Maleque*  
7

**Chapter 3**  
Fabrication of Nickel Aluminide (Ni$_3$Al) by Hot Isostatic Pressing (HIP)  
Fatizal Abu Zarim, Iraj Alaei, I.I. Yaacob  
13

**Chapter 4**  
Investigation of Mechanically Alloyed Nd-Fe-B Powder  
I.I. Yacoob and H.K. Jun  
17

**Chapter 5**  
Synthesis And Characterization Of Nanocrystalline Ni$_3$Al Intermetallic Produced by Mechanical Alloying And Reaction Synthesis  
*R. Ismail and I.I. Yaacob*  
23

**Chapter 6**  
The Effect of Hard Nanofillers on Mechanical Properties of PVC Nanocomposites  
*Noorasikin Samat, Muhammad Alif Mohd Yusoff and Mohd Shahrul Rizal Bin Zakaria*  
29

**Chapter 7**  
Fatigue Fracture Mechanism of PVC/CaCO$_3$ nanocomposite  
*Noorasikin Samat, Alan Whittle and Mark Hoffman*  
34

**Chapter 8**  
Mechanical Behaviour of Eco Core Composite Sandwich Structure  
*Norhasnidawani Johari, Safiyah Hazwani Abd. Rahim and Zahurin Halim*  
40

**Chapter 9**  
Characteristics of Oil Palm Biomass via Mixture of Empty Fruit Bunch (EFB) Fiber and Mesocarp Fiber  
*Zahurin Halim, Nabiha Mohd Noh and Nurshazana Mohamad*  
45

**Chapter 10**  
Mechanical Behaviour of Oil Palm Empty Fruit Bunch (OPEFB) Albumen-Composites Concrete  
49
Chapter 11
The Influence of Biopolymer and Natural Fiber on the Physical and Mechanical Properties of Cement Composite

Norshahida Sarifuddin and Zuraida Ahmad

Chapter 12
Thermal and Morphological Study of Biopolymer Cotton-Albumen Clay (BCAC) Composites

Zuraida Ahmad, Teoh Swin Le and Kumaran A/L Sambandamuthiah

Chapter 13
Effect of Compaction Time on the Properties of Coir Fiber Reinforced Cement-Albumen Composite

Amir Zakwan Roslin, Nur Humairah A. Razak and Zuraida Ahmad

Chapter 14
Oil Palm Empty Fruit Bunch (OPEFB) for Lightweight Composites Concrete

Afiqah Omar, Nur Humairah A. Razak and Zuraida Ahmad

Chapter 15
Fabrication of Metal Matrix Composite Automotive Brake Rotor (Part 1)

Md Abdul Maleque

Chapter 16
Fabrication of Metal Matrix Composite Automotive Brake Rotor (Part 2)

Md Abdul Maleque

Chapter 17
Wear of Aluminium Matrix Composite – Effects of Reinforcement Combination

Md Abdul Maleque and Rezaul Karim

Chapter 18
Mechanical Properties of Wood Plastic Composites

Ooi Chong Jin and Shahjahan Mridha

Chapter 19
Properties of Wood Fiber Reinforced Polypropylene Composite

Shahjahan Mridha and Nafis Sarwar Islam
Chapter 20
The effects of chemical and mechanical treatments on coir fibre to mechanical properties of coir-albumen-concrete

Zuraida Ahmad and Nurizan Omar

Chapter 21
Architecture of Chopped Fiber Glass in Plastic Composite Processed Under Different Loads

Ahmed Nazrin Md Idriss and Shahjahan Mridha

Chapter 22
Variation of Fiber Architecture on Loads applied in Fabrication of Epoxy/Woven Fiber Glass Composite

Ahmed Nazrin Md Idriss and Shahjahan Mridha

Chapter 23
Impact Behavior of Carbon/ Epoxy Composite in Moisture and Temperature environments

Shahjahan Mridha

Chapter 24
Impact Strength Behaviour of the Woven and Chopped Fiber Glass Composites at Different Temperatures

Ahmed Nazrin Md Idriss and Shahjahan Mridha

Chapter 25
An Investigation of Hybrid Composites Tubes Subjected to Quasi-Static Loading

Farrah Yusof and Zuraida Ahmad

Chapter 26
Mechanical Behaviour of Biopolymer Cotton Albumen Clay (BCAC) Composites

Teoh Swin Le, Kumaran A/L Samannamuthaliar and Zuraida Ahmad

Chapter 27
The Effect of Processing Parameters on Tensile Properties Empty Fruit Bunch (EFB) Fiber Reinforced Thermoplastic Natural Rubber Composites

Noor Azlina Hassan, Norita Hassan, Sahrin Hj. Ahmad and Rozaidi Rasid

Chapter 28
Manganese Doped Hydroxyapatite Powder through Hydrothermal Method

Asep Sofwan Faturrohman, Alqap, Iis Sopyan and Nur Izzati Mzmaa
Chapter 29
Synthesis and Characterization of Sol-Gel Method Derived Zinc Doped Hydroxyapatite Powder

Asep Sofwan Futurohman Alqap, Nor Hidayu and Iis Sopyan

Chapter 30
Synthesis and Characterization of Nickel Iron–Silicon Nitride Nanocomposite

Iskandar I. Yaacob

Chapter 31
Fabrication of Nickel Aluminide Intermetallic-Alumina Nanocomposite

Roslina Ismail and Iskandar I. Yaacob

Chapter 32
Investigation on the Effect of Water Immersion on Cotton Albumen Composite

Zahurin Halim, Zuraida Ahmad and Fauziah Md Yusof

Chapter 33
Numerical and Experimental Investigation of Peel Strength of Composite Sandwich Structures

Zahurin Halim, Shahnor Basri and Mohd Ramli Ajir

Chapter 34
Finite Element Analysis of Interlaminar Stresses in Edge Delamination

Zahurin Halim and Meer Mohd. Adli Taib
Chapter 006

The Effect of Hard Nanofillers on Mechanical Properties of PVC Nanocomposites

Noorasikin Samat¹, Muhammad Alif Mohd Yusoff¹ and Mohd Shahrul Rizal bin Zakaria¹
¹Kulliyyah of Engineering – International Islamic University Malaysia
✉: noorasikin@iium.edu.my

Keywords: alumina, pvc, mechanical properties, nanocomposites, impact, modulus.

Abstract: The mechanical properties and morphology of a series of PVC/alumina nanocomposites were investigated and presented in this chapter. The nanocomposites were fabricated at different composition of alumina (0, 1, 2.5 and 5wt %) and silane was used to modified the surface area of the nanoparticles. The mechanical properties were studied via tensile and impact properties and the scanning electron microscope (SEM) were used to examine the morphology of the nanocomposites. The results showed that the mechanical properties of strength decreases slightly and modulus of the nanocomposites increases with addition of 2.5 wt% of alumina. Optimum impact strength was also obtained at 2.5 wt% of alumina.

Introduction

Light weight and ease in processing have made polymers as a main choice material for a wide range of applications. In spite of these advantages, polymers have poor mechanical, thermal and electrical properties as compared to metals and ceramics. The most common approach to improve these drawbacks is by incorporating fillers and this new material is known as polymer composites. Polymers that filled with nano-sized particles have offered unique properties, which are not obtained with micron-sized particles. The incorporation of small amount (less than 20 wt%) of nanofillers results in improvement in the modulus and strength of nanocomposites.

Indeed, the outstanding properties of polymer nanocomposites are associated with the interaction between the nanoparticles and polymer. This indicates that the filler-matrix interface is crucial as it affects significantly the properties of nanocomposites. In addition, it is well known that the nano-sized particles tend to agglomerate due to its high surface area. As a result, surface modification of nano particles with coupling agents such as silanes and titanates is required to ensure homogeneous distribution of these nanoparticles in polymer matrix. Alumina (Al₂O₃) nanoparticle has successful reinforced some polymers [1]. Therefore, the nano-sized alumina was used to reinforce PVC in the current study. And silane was used to modify the surface of alumina nanoparticle.

Experimental Procedure