

ADVANCES IN MATERIALS ENGINEERING

Volume 1

Edited By:
Zahurin Halim
Iskandar Idris Yaacob
Md Abdul Maleque



IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

ADVANCES IN MATERIALS ENGINEERING VOLUME 1

Edited By:

Zahurin Halim
Iskandar Idris Yaacob
Md Abdul Maleque



IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011
©IIUM Press, IIUM

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without any prior written permission of the publisher.

Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

ISBN: 978-967-418-167-3

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

Printed by :
IIUM PRINTING SDN. BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan

Table of Content

| | |
|--|----|
| Chapter 1 Preparation and Characterization of Thermoplastic Natural Rubber (TPNR) Nanocomposites <i>Noor Azlina Hassan, Sahrim Hj. Ahmad, Rozaidi Rasid and Norita Hassan</i> | 1 |
| Chapter 2 Polymer Clay Nanocomposites: Part I <i>Noor Azlina Hassan and Norita Hassan</i> | 6 |
| Chapter 3 Effect of Processing Parameters on the Tensile Properties of TPNR Reinforced Short Carbon Fibre Composite <i>Hazleen Anuar, Sahrim Hj. Ahmad and Rozaidi Rasid</i> | 11 |
| Chapter 4 Effect of Maleic Anhydride Polyethylene on Damping Properties of HDPE/EPDM Nanocomposite <i>Hazleen Anuar, Nur Ayuni Jama, and Shamsul Bahri Abdul Razak</i> | 16 |
| Chapter 5 Comparative Study on the Effect of Plasticizer on Thermal Properties of Polylactic Acid <i>Hazleen Anuar and Muhammad Rejaul Kaiser</i> | 22 |
| Chapter 6 Quality of Copper Film Electroplated on Silicon Wafer Using Different Current Densities <i>Shahjahan Mridha</i> | 28 |
| Chapter 7 Laser Nitriding of Titanium <i>Shahjahan Mridha</i> | 39 |
| Chapter 8 Composite Coating on Titanium Alloy Using High Power Laser <i>Shahjahan Mridha</i> | 45 |

| | | |
|--|--|-----|
| Chapter 9 | | |
| Measurement of Moisture Absorption in Borophosphosilicate Glass (BPGS) Films | | 50 |
| | <i>Shahjahan Mridha and Shiau Khee Tang</i> | |
| Chapter 10 | | 58 |
| The Effect of Processing Parameter on Tensile Properties of Thermoplastic Natural Rubber Nanocomposites | | |
| | <i>Noor Azlina Hassan, Sahrim Hj. Ahmad, Rozaidi Rasid and Norita Hassan</i> | |
| Chapter 11 | | 64 |
| Comparison of Mechanical Properties Between Untreated and Sulphuric Acid Treated Short Carbon Fiber Reinforced Thermoplastic Natural Rubber (TPNR) Composite | | |
| | <i>Noor Azlina Hassan, Norita Hassan, Sahrim Hj. Ahmad and Rozaidi Rasid</i> | |
| Chapter 12 | | 69 |
| Water Absorption of TPNR Reinforced Short Carbon Fibre Composite | | |
| | <i>Hazleen Anuar, Sahrim Hj. Ahmad and Rozaidi Rasid</i> | |
| Chapter 13 | | 74 |
| Enhanced Tensile Strength with Sulphuric Treated Short Carbon Fibre | | |
| | <i>Hazleen Anuar, Sahrim Hj. Ahmad and Rozaidi Rasid</i> | |
| Chapter 14 | | 79 |
| Effect of Fibre Length on Tensile Properties of TPNR-Kenaf Fibre Composite | | |
| | <i>Hazleen Anuar, Sahrim Hj. Ahmad and Rozaidi Rasid</i> | |
| Chapter 15 | | 84 |
| Effect of Nanoclay on Mechanical Properties of PLA-Clay Nanocomposite | | |
| | <i>Hazleen Anuar and Muhammad Rejaul Kaiser</i> | |
| Chapter 16 | | 90 |
| Extraction of Glucose From Kenaf Core by Using Chemical Pre – Treatment Process | | |
| | <i>Nurhafizah Seeni Mohamed, Hazleen Anuar, Maizirwan Mel, Rashidi Othman, Nur Aisyah Mohd Norddin, Nur Aimi Mohd Nasir, Mohd Adlan Mustafa Kamalbhryn</i> | |
| Chapter 17 | | 96 |
| Wear of Nitride Coating Produced by Ti-Al Melt Synthesis in Nitrogen Environment | | |
| | <i>Shahjahan Mridha</i> | |
| Chapter 18 | | 103 |
| Effect of Dispersant on Protein Foaming-Consolidation Porous Alumina Containing Hydrothermal Derived Hydroxyapatite Nanopowder | | |
| | <i>Iis Sopyan and Ahmad Fadli</i> | |

| | |
|---|---|
| Chapter 19 | 109 |
| Effect of Yolk Addition on Protein Foaming-Consolidation Porous Alumina-Calcium Phosphate Composites | |
| | <i>Iis Sopyan and Ahmad Fadli</i> |
| Chapter 20 | 115 |
| Investigation of the Effect of Starch Addition on Protein Foaming-Consolidation Porous Alumina Containing Hydroxyapatite Nanopowder | |
| | <i>Ahmad Fadli', Iis Sopyan, Nur Syahidah and Nur Nadia</i> |
| Chapter 21 | 120 |
| The Influence of Hydroxyapatite Loading on Protein Foaming-Consolidation Porous Alumina Sintered at 1300°C | |
| | <i>Ahmad Fadli 'and Iis Sopyan</i> |
| Chapter 22 | 126 |
| High Density Polyethylene (HDPE) as an Alternative Material in Fuel Tank Production | |
| | <i>Afiqah Afdzahuddin and Md Abdul Maleque</i> |
| Chapter 23 | 132 |
| Porous Alumina-Hydroxyapatite Composites via Protein Foaming-Consolidation Method: Effect of HA Loading on Physical Properties | |
| | <i>Iis Sopyan, Ahmad Fadli and Nur Izzati Zulkifli</i> |
| Chapter 24 | 137 |
| Preparation and Characterisation of Low Density Polyethylene/Layered Silicate Nanocomposites | |
| | <i>Salina Sharifuddin , Iskandar Idris Yaacob</i> |
| Chapter 25 | 144 |
| Effects of Sodium Dodecyl Benzene Sulphonate (NaDBs) on Li Imide-PMMA Based Solid Polymer Electrolyte | |
| | <i>Fauziah Mohd Yusof and Iskandar Idris Yaacob</i> |
| Chapter 26 | 149 |
| Effect of Milling Time on Mechanochemically Synthesized Nanohydroxyapatite Bioceramics | |
| | <i>Iis Sopyan, S. Adzila and M. Hamdi</i> |
| Chapter 27 | |
| Morphological Analysis of Mechanochemically Synthesized Nanohydroxyapatite Bioceramics | 155 |
| | <i>Iis Sopyan, S. Adzila and M. Hamdi</i> |
| Chapter 28 | 160 |
| Sodium Doped Nanohydroxyapatite Bioceramics through Mechanochemical Synthesis | |
| | <i>S. Adzila, Iis Sopyan and M. Hamdi</i> |

| | |
|---|-----|
| Chapter 29 | 165 |
| Thermal Profile Analysis of Composite Brake Rotor | |
| <i>Md Abdul Maleque and Abdul Mu'min Adebisi</i> | |
| Chapter 30 | 172 |
| The Effect of Fibre Content on Thermal Property of Coir Fibre Reinforced Cement-Albumen Composite | |
| <i>Faridatul Faezah Razali, Nur Humairah Abdul Razak and Zuraida Ahmad</i> | |
| Chapter 31 | 178 |
| Pulsed Electrodeposition | |
| <i>Suryanto</i> | |
| Chapter 32 | 184 |
| Electroless Nickel Based Coatings From Solution Containing Sodium Hypophosphite | |
| <i>Suryanto</i> | |
| Chapter 33 | 189 |
| Characterization and Utilization of Fly Ash | |
| <i>Suryanto</i> | |
| Chapter 34 | 195 |
| Workability of Coir Fibre- Reinforced Cement-Albumen Composite | |
| <i>Nur Humairah Abdul Razak and Zuraida Ahmad</i> | |
| Chapter 35 | 201 |
| Preparation of Rice Husk for Raw Material of Silicon | |
| <i>Hadi Purwanto and Nor Fazilah Mohd Selamat</i> | |

Preparation of Rice Husk for Raw Material of Silicon

Hadi Purwanto¹ and Nor Fazilah Mohd Selamat²

^{1,2} Faculty of Engineering – International Islamic University Malaysia

✉ : hadi@iiu.edu.my; / ✉ : fazzy_ukhuwahabada@yahoo.com

Keywords: Rice husk, silicon production, gasification, biomass.

Abstract. Rice husk is a by-product of paddy mill that estimated about 22% of rice production. In Malaysia, rice husk produced annually about 528000 tones. The conventional process of rice husk is directly burned which cause an environmental problem. As a biomass sources rice husk has a big potential as energy and materials resources. A new process has been proposed to utilize both energy and solid material, started with gasification and followed by reduction of silica using synthetic gas and carbon as the products of gasification. This work describes the characteristics of rice husk ash (RHA) produced local paddy milling in Malaysia during gasification. Energy analysis was carried out based on the thermodynamic calculation of available energy in rice husk and energy required for the reduction process. The results show that the RHA contained 85% silica and 15% solid carbon. The ash has non crystalline structure indicated an amorphous form and the ash produced by gasification at high temperature lead to silicon carbide (SiC) formation. The SiC was recognized using the X-ray diffraction after mechanical grinding treatment. Thermodynamical analysis shows that the utilization of available solid carbon and silica in the RHA could reduce about 12.4% of carbon consumption in reduction process of silica.

Introduction

Rice husks are agro wastes produced in large amounts of about 528000 tones per year in Malaysia as the product of an average 20 – 22% from the amount 2.4 millions tons of rice production [1,2]. It is well known as one of the most promising agricultural by products because of its possible use or application for the production of a variety of inorganic materials. The major constituents in rice husks are ash and organics such as cellulose, hemi – cellulose and lignin. The major element contained in the rice husk is silicon that exists in the protuberances and hairs on the outer and inner epidermis of the rice husks [3]. The silicon appears in the form of silica ashes through the thermal process on the rice husks. Otherwise, in paddy industry the rice husks are wasted and thus creating a disposal problem. Recently, rice husks have been burnt in open fields as away for disposal causing environmental problems. So, this research has been developed to examine the feasibility of utilizing rice husks for silicon production.

In previous studies, in order to obtain the high purity silica, it must be leached with strong acid solutions so as to remove metallic impurities from rice husks [4]. However, these methods are hazardous to the environment and to human safety in addition to being expensive. The increase of the processing cost resulting from the necessary use of expensive corrosion resistant materials for leaching baths and the repetition of water rinsing of acid leached materials, etc. Gasification is a process that converts biomass into gas [5,6]. The gasification process can be used to give the thermal process on the rice husks. The products from the gasification process like ashes containing silicon and gases are used as raw materials for silicon and energy in the silicon production process.