ADVANCES IN MATERIALS ENGINEERING VOLUME 1

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Table of Content

Chapter 1
Preparation and Characterization of Thermoplastic Natural Rubber (TPNR) Nanocomposites

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

Chapter 2
Polymer Clay Nanocomposites: Part I

Noor Azlina Hassan and Norita Hassan

Chapter 3
Effect of Processing Parameters on the Tensile Properties of TPNR Reinforced Short Carbon Fibre Composite

Hazleen Anuar, Sahrim Hj. Ahmad and Rozaidi Rasid

Chapter 4
Effect of Maleic Anhydride Polyethylene on Damping Properties of HDPE/EPDM Nanocomposite

Hazleen Anuar, Nur Ayuni Jama, and Shamsul Bahri Abdul Razak

Chapter 5
Comparative Study on the Effect of Plasticizer on Thermal Properties of Polylactic Acid

Hazleen Anuar and Muhammad Rejaul Kaiser

Chapter 6
Quality of Copper Film Electroplated on Silicon Wafer Using Different Current Densities

Shahjahan Mridha

Chapter 7
Laser Nitriding of Titanium

Shahjahan Mridha

Chapter 8
Composite Coating on Titanium Alloy Using High Power Laser

Shahjahan Mridha
Chapter 9
Measurement of Moisture Absorption in Borophosphosilicate Glass (BPGS) Films

Shahjahan Mridha and Shian Khee Tang

Chapter 10
The Effect of Processing Parameter on Tensile Properties of Thermoplastic Natural Rubber Nanocomposites

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

Chapter 11
Comparison of Mechanical Properties Between Untreated and Sulphuric Acid Treated Short Carbon Fiber Reinforced Thermoplastic Natural Rubber (TPNR) Composite

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

Chapter 12
Water Absorption of TPNR Reinforced Short Carbon Fibre Composite

Hazleen Anuar, Sahrim Hj. Ahmad and Rozaidi Rasid

Chapter 13
Enhanced Tensile Strength with Sulphuric Treated Short Carbon Fibre

Hazleen Anuar, Sahrim Hj. Ahmad and Rozaidi Rasid

Chapter 14
Effect of Fibre Length on Tensile Properties of TPNR-Kenaf Fibre Composite

Hazleen Anuar, Sahrim Hj. Ahmad and Rozaidi Rasid

Chapter 15
Effect of Nanoclay on Mechanical Properties of PLA-Clay Nanocomposite

Hazleen Anuar and Muhammad Rejaul Kaiser

Chapter 16
Extraction of Glucose From Kenaf Core by Using Chemical Pre – Treatment Process

Nurhaflizah Seemi Mohamed, Hazleen Anuar, Maizirwan Mel, Rashidi Othman, Nur Aisyah Mohd Nordin, Nur Aimi Mohd Nasir, Mohd Adlan Mustafa Kamalbhiri

Chapter 17
Wear of Nitride Coating Produced by Ti-Al Melt Synthesis in Nitrogen Environment

Shahjahan Mridha

Chapter 18
Effect of Dispersant on Protein Foaming-Consolidation Porous Alumina Containing Hydrothermal Derived Hydroxyapatite Nanopowder

Iis Sopyan and Ahmad Fadli
Chapter 19
Effect of Yolk Addition on Protein Foaming-Consolidation Porous Alumina-Calcium Phosphate Composites

Iis Sopyan and Ahmad Fadli

Chapter 20
Investigation of the Effect of Starch Addition on Protein Foaming-Consolidation Porous Alumina Containing Hydroxyapatite Nanopowder

Ahmad Fadli, Iis Sopyan, Nur Syahidah and Nur Nadia

Chapter 21
The Influence of Hydroxyapatite Loading on Protein Foaming-Consolidation Porous Alumina Sintered at 1300°C

Ahmad Fadli and Iis Sopyan

Chapter 22
High Density Polyethylene (HDPE) as an Alternative Material in Fuel Tank Production

Afiqah Afizaluddin and Md Abdul Maleque

Chapter 23
Porous Alumina-Hydroxyapatite Composites via Protein Foaming-Consolidation Method: Effect of HA Loading on Physical Properties

Iis Sopyan, Ahmad Fadli and Nur Izzati Zulkifli

Chapter 24
Preparation and Characterisation of Low Density Polyethylene/Layered Silicate Nanocomposites

Salina Sharifuddin, Iskandar Idris Yaacob

Chapter 25
Effects of Sodium Dodecyl Benzene Sulphonate (NaDbs) on Li Imide-PMMA Based Solid Polymer Electrolyte

Fauziah Mohd Yusof and Iskandar Idris Yaacob

Chapter 26
Effect of Milling Time on Mechanochemically Synthesized Nanohydroxyapatite Bioceramics

Iis Sopyan, S. Adzila and M. Hamdi

Chapter 27
Morphological Analysis of Mechanochemically Synthesized Nanohydroxyapatite Bioceramics

Iis Sopyan, S. Adzila and M. Hamdi

Chapter 28
Sodium Doped Nanohydroxyapatite Bioceramics through Mechanochemical Synthesis

S. Adzila, Iis Sopyan and M. Hamdi
Chapter 29
Thermal Profile Analysis of Composite Brake Rotor
Md Abdul Maleque and Abdul Mu’min Adebisi

Chapter 30
The Effect of Fibre Content on Thermal Property of Coir Fibre Reinforced Cement-Albumen Composite
Faridaul Faezah Razali, Nur Humairah Abdul Razak and Zuraida Ahmad

Chapter 31
Pulsed Electrodeposition
Suryanto

Chapter 32
Electroless Nickel Based Coatings From Solution Containing Sodium Hypophosphite
Suryanto

Chapter 33
Characterization and Utilization of Fly Ash
Suryanto

Chapter 34
Workability of Coir Fibre- Reinforced Cement-Albumen Composite
Nur Humairah Abdul Razak and Zuraida Ahmad

Chapter 35
Preparation of Rice Husk for Raw Material of Silicon
Hadi Purwanto and Nor Fazilah Mohd Selamat
Preparation of Rice Husk for Raw Material of Silicon

Hadi Purwanto 1 and Nor Fazilah Mohd Selamat 2

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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, hemicellulose 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.