ADVANCES IN MATERIALS ENGINEERING

Volume 1

Edited By:
Zahurin Halim
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Md Abdul Maleque

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Chapter 035

Preparation of Rice Husk for Raw Material of Silicon

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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. Thermodymical 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.