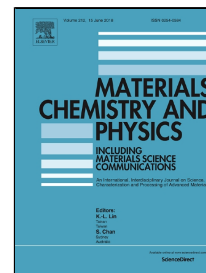


Accepted Manuscript

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PII: S0254-0584(18)30415-2
DOI: 10.1016/j.matchemphys.2018.05.019
Reference: MAC 20634
To appear in: *Materials Chemistry and Physics*
Received Date: 02 January 2018
Revised Date: 09 April 2018
Accepted Date: 11 May 2018

Please cite this article as: Zulhelmi Alif Abdul Halim, Muhamad Azizi Mat Yajid, Mohd Hasbullah Idris, Halimaton Hamdan, Physiochemical and Thermal Properties of Silica Aerogel–Poly Vinyl Alcohol / Core–Shell Structure Prepared using Fluidized Bed Coating Process for Thermal Insulation Applications, *Materials Chemistry and Physics* (2018), doi: 10.1016/j.matchemphys.2018.05.019

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Physiochemical and Thermal Properties of Silica Aerogel–Poly Vinyl Alcohol / Core–Shell Structure Prepared using Fluidized Bed Coating Process for Thermal Insulation Applications

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Running Title: Silica aerogel – PVA / Core – Shell Structure

Abstract

This work proposes a process for the fabrication of a silica aerogel (SA)–polyvinyl alcohol (PVA) core–shell structure using the fluidized bed method. First, nearly spherical hydrophobic SA particles with a diameter between 0.5 mm and 3.0 mm were prepared from rice husk ash via a sodium silicate route and ambient-pressure drying. Subsequently, a specific batch size of the SA particles was suspended in a heated air stream and sprayed with aqueous PVA using a bottom nozzle via the fluidized bed process. Coating of an individual SA particle is possible for large particle sizes and hydrophobization of the SA surface prevents penetration of PVA into its pores. The core–shell structured material showed a combination of high thermal insulation and good mechanical stability, rendering it suitable for use as filler in polymer resin, paints, and coatings. The core–shell structured material had an average density of 0.09 g.cm⁻³ with well-preserved SA pores. The average shell volume fraction was 2.5%; the shell thickness varied below 50 µm, and was mostly approximately 20 ± 5 µm. Thermal analysis using transient plane hot-disk method and thermogravimetric analysis showed that the SA–PVA / core–shell structure exhibited lower thermal conductivity (0.035 W/mK) and higher thermal stability than uncoated SA.

Keywords: Silica aerogel; Polymer coating; Thermal insulation; Thermal stability

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