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IIUM Engineering Journal Open Access
Volume 21, Issue 2, 2020, Pages 230-238

Preparation and characterizations of latex / filler nanocomposites (Article) (Open Access)

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Abstract

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Latex compounding which incorporates various types of clays as filler to the rubber can significantly give reinforcement in the rubber matrix when rubber/clay nanocomposites are formed, but the filler agglomerates. Thus, study was conducted by using Kaolin clay as the filler in the rubber nanocomposites with silane coupling agent to functionalize the surface of the filler. This study was done in order to investigate the mechanical properties of various functionalized Kaolin in latex nanocomposites, to prepare various ratios of Kaolin to rubber, and to characterize mechanical, thermal and morphological properties of the Kaolin in latex nanocomposites. To achieve these, six types of silane coupling agents was used for Kaolin filler surface functionalization purpose during the filler's incorporation in latex compounding. The optimized coupling agent, USi-7301 (γ-chloropropyltrimetoxysilane)-with tensile strength value of 32.77 MPa, elongation at break value of 632.589 % and force at break value of 6.737 N-was used to further functionalize Kaolin filler in different ratios so as to achieve the optimum mechanical, thermal and morphological properties of the filler in the polymer matrix. Universal tensile machine was used to analyze the mechanical properties of the nanocomposites, while the Scanning Electron Microscopy (SEM) and Differential Scanning Calorimetry (DSC) were used to observe the morphological and thermal properties of the nanocomposites, respectively. The results showed that reducing the Total Solids Content (TSC) of Kaolin filler to 26 % somehow showed the optimized properties of the nanocomposites, giving 34.00 MPa tensile strength, 576.494 % elongation at break and 6.564 N force at break. Rough surface morphology was observed under SEM suggesting the occurrence of phase separation between the hydrophilic filler and the hydrophobic rubber matrix. In the DSC plot, sample with USi-7301 and with functionalized Kaolin filler 26 % TSC showed glass transition temperature shifted to lower region compared to normal nitrile rubber. The reinforcement of nanocomposites formed will not only enhance the properties of the nanocomposites, but is also economically feasible thus brings advantages to the industry. © 2020, International Islamic University Malaysia-IIUM.

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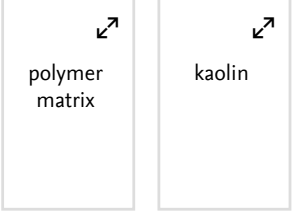

Author keywords

Filler | Latex | Nanocomposites | Rubber | Silane coupling agent

Funding details

Funding text

The corresponding author would like to thank IIUM Faculty of Engineering and Top Glove Sdn. Bhd. and its R&D department for the supports in accomplishing this project. Not to forget, also thanks to Top Glove's main chemical and equipment suppliers for this project for samples preparation and characterizations. Top Glove company, the world's largest rubber glove manufacturer had also provided space in their production line for the samples' production.

ISSN: 1511788X
DOI: 10.31436/iiumej.v21i2.1388
Source Type: Journal
Document Type: Article
Original language: English
Publisher: International Islamic University Malaysia-IIUM

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