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Preparation and Characterization of Polypyrrole/Attapulgite with Organic Surface Modification Conducting Composite

Journal	Advanced Materials Research (Volumes 160 - 162)
Volume	Materials Science and Engineering Applications
Edited by	Guojun Zhang and Jessica Xu
Pages	1126-1130
DOI	10.4028/www.scientific.net/AMR.160-162.1126
Citation	Hui Xia Feng et al., 2010, Advanced Materials Research, 160-162, 1126
Online since	November, 2010
Authors	Hui Xia Feng, Sheng Li Liu, Jian Qiang Zhang
Keywords	Attapulgite, Conducting Nano-Composite Material, Organic Surface Modification, Polypyrrole, Silane Coupling Agent, Sulfamic Acid

Abstract	Attapulgite was organic surface modified with silane coupling agent (KH570) and acetone, with ferric chloride (FeCl3·6H2O) as the oxidant, sulfamic acid(SA) as dopant, prepared polypyrrole/attapulgite with organic surface modification conducting nano-composite materials (PPy/ATTP-KH) by chemical oxidation polymerization, and using IR, XRD and SEM characterization methods to characterize Internal structure of composite materials obtained. The results show that in the condition of n(Py):n(FeCl3·6H2O):n(SA) =1:1:0.5, and with the increase of contents, composite conductivity increased and then decreased, when the contents of attapulgite is to 50%, the conductivity reaches maximum 30.0 S•cm-1. We can see from the IR spectrum, silane coupling agent and hydroxyl of attapulgite surfaces have a chemical bonding, and plays a good modification to the surfaces of attapulgite, Thereby enhancing the conductivity of the composite materials.

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Advanced Materials Research Vols. 160-162 (2011) pp 1126-1130
Online available since 2010/Nov/11 at www.scientific.net
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doi:10.4028/www.scientific.net/AMR.160-162.1126

Preparation and characterization of polypyrrole/attapulgite with organic surface modification conducting composite

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Keywords: Attapulgite; Polypyrrole; Sulfamic acid; silane coupling agent; organic surface modification; conducting nano-composite materials

Abstract: Attapulgite was organic surface modified with silane coupling agent (KH570) and acetone, with ferric chloride ($FeCl_3{\cdot}6H_2O$) as the oxidant, sulfamic acid(SA) as dopant, prepared polypyrrole/attapulgite with organic surface modification conducting nano-composite materials (PPy/ATTP-KH) by chemical oxidation polymerization, and using IR, XRD and SEM characterization methods to characterize Internal structure of composite materials obtained. The results show that in the condition of n(Py):n($FeCl_3{\cdot}6H_2O$):n(SA) =1:1:0.5, and with the increase of contents, composite conductivity increased and then decreased, when the contents of attapulgite is to 50%, the conductivity reaches maximum 30.0 $S{\cdot}cm^{-1}$. We can see from the IR spectrum, silane coupling agent and hydroxyl of attapulgite surfaces have a chemical bonding, and plays a good modification to the surfaces of attapulgite, Thereby enhancing the conductivity of the composite materials.

Introduction

Conducting polymers such as Polypyrrole (PPy) and polyaniline (PANI) have attracted researchers because of their unique redox, optical, and electrical properties. It has received considerable attention in years due to its straightforward polymerization, chemical stability, relatively high conductivity, and potential applications in electronic devices, batteries, synthetic membranes, nonlinear optical elements and sensors[1-5].

In the case of conducting polymer/inorganic composites, they provide the new synergistic properties, which cannot attain from individual materials, such that the conductivity is more easily controlled, and the mechanical or thermal stability is improved through the synthesis of the composites.

Attapulgite (or palygorskite-as it often called) is a crystalline hydrated magnesium aluminum silicate with unique three-dimensional structure and has a fibrousmorphology. The structure of fibrous minerals differs from that of layered silicates used in nanocomposites in which there is a lack of continuous octahedral sheets. There have been some reports of the use of ATTP in rubbers [6], thermoplastic polymers [7].

At the present time, several approaches of preparing PANI/ATTP nanocomposite have been reported [8-10]. In this paper, we prepared the polypyrrole/attapulgite with organic surface modification conducting nano-composite materials (PPy/ATTP-KH) by chemical oxidation polymerization for the first time. As the host, ATTP is a type of natural fibrillar silicate clay mineral and its fibrillar single crystal is the smallest structure unit with a length of 500–2000 nm