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New POSS/magnesium silicate nano-hybrids obtained by chemical or mechanical methods

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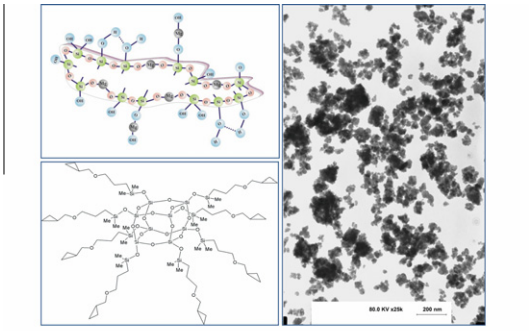
HIGHLIGHTS

- Two synthesis methods of POSS/inorganic silicate hybrid materials were proposed.
- Structural and dispersive characteristic of the hybrid materials were presented.
- The obtained materials exhibited excellent properties for further applications.

GRAPHICAL ABSTRACT



OCTAKIS(DIMETHYLSILOXY,3 -GLYCIDOXYPROPYL)OCTASILSESQUIOXANE /MAGNESIUM SILICATE NANO-HYBRID

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ABSTRACT

New organic/inorganic hybrid systems were obtained by chemical or mechanical modification of magnesium silicate surface with selected POSS, and then characterized. Magnesium silicate was precipitated in a water system. The effect of modification of the magnesium silicate surface on its physicochemical properties was determined. Functionalization was carried out with the use of selected POSS: octakis(methacryloxypropyl)octakisilsesquioxane and octakis(dimethylsiloxy, 3-glycidoxypropyl)octasilsesquioxane. The organic/inorganic hybrid systems were characterized through determination of their particle size and tendency to form agglomerates using scanning electron microscopy (SEM) and transmission electron microscopy (TEM), the non-invasive backscattering method (NIBS) and a laser diffraction technique. The adsorption properties of the systems were evaluated on the basis of nitrogen adsorption/desorption isotherms, specific surface area, pore volume and size. Water wettability profiles were also examined. Additionally, thermal stability was measured by thermogravimetric (TGA) analysis.

To evaluate the effectiveness of the applied chemical modification, the hybrids underwent FT-IR testing and determination of the degree of surface coverage based on elemental contents.

1. Introduction

Many natural materials are highly integrated hybrid systems characterized by different properties or functions (mechanical properties, density, permeability, color, hydrophobicity).

A characteristic trait of hybrid materials is that their properties are not only related to the chemical nature of the inorganic and organic components, but also depend heavily on their synergy. Therefore the interface between inorganic and organic parts strongly influences their properties. Hybrids can also be characterized by the type and size of their organic or inorganic precursors. The precursors can be two separate monomers or polymers, or they can be covalently linked. Generally, phase separation between the organic and the inorganic components will occur, due to mutual

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