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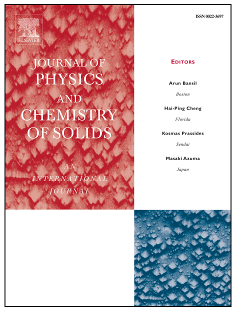

Facile and low energy consumption synthesis of microencapsulated phase change materials with hybrid shell for thermal energy storage

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Facile and low energy consumption synthesis of microencapsulated phase change materials with hybrid shell for thermal energy storage

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ABSTRACT: We designed a photocurable pickering emulsion polymerization to create microencapsulated phase change materials (MicroPCM) with polymer-silica hybrid shell. The emulsion was stabilized by modified SiO_2 particles without any surfactant or dispersant. The polymerization process can be carried out at ambient temperature only for 5 min ultraviolet radiation, which is a low-energy procedure. The resultant capsules were shown a good core-shell structure and uniform in size. The surface of the microcapsules was covered by SiO_2 particles. According to the DSC and TGA examinations, the microcapsules has good thermal energy storage-release performance, enhanced thermal reliability and thermal stability. When ratio of MMA/ n-octadecane was 1.5/1.5. The encapsulation efficiency of the microcapsules reached 62.55%, accompanied with 122.31 J/g melting enthalpy. The work is virtually applicable to the construction of a wide variety of organic-inorganic hybrid shell MicroPCM. Furthermore, with the application of this method, exciting opportunities may arise for realizing rapid, continuous and large-scale industrial preparation of MicroPCM.

Keywords: Energy storage and coversion; Phase transformation; Thermal analysis; Microcapsulated PCM; Photocurable; pickering emulsion

1. Introduction

In recent years, the researches on the developing and utilizing new green energy sources has been gaining more and more attention [1]. Worth mentioning in these resources is a technique of latent heat storage employing phase change materials (PCM), which have become a hotspot in the study of thermal energy storage materials due to their high energy storage density, isothermal operating characteristics, and extremely small temperature variation during charging and discharging processes [2]. Therefore, phase change energy storage technology have been applied to many fields such as heat storage fibers [3], regulation of building temperature [4, 5], solar heating systems and heat recovery [6, 7].

Encapsulated phase change materials (MicroPCM) is a key issue for the application of phase change materials [8, 9]. Microencapsulation can prevent leakage of the melted PCM during the phase change process, reduce PCM reactivity with the outside environment, enlarge heat transfer area and increase the heat transfer rate [10, 11]. These features make them more functional than pristine PCM in their application [12]. Nowadays, various methods have been developed for the encapsulation of PCM, such as interfacial polycondensation [13], suspension polycondensation [14], in situ polycondensation [15], and complex coacervation [16]. However, all these conventional methods are employed surfactant or dispersant to stable emulsion, which would

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