World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:13, No:06, 2019

Synthesis and Characterization of Capric-Stearic Acid/ Graphene Oxide-TiO_2 Microcapsules for Solar Energy Storage and Photocatalytic Efficiency

Authors : Ghada Ben Hamad, Zohir Younsi, Hassane Naji, Noureddine Lebaz, Naoual Belouaggadia

Abstract : This study deals with a bifunctional micro-encapsulated phase change (MCP) material, capric-stearic acid/graphene oxide-TiO2, which has been successfully developed by in situ hydrolysis and polycondensation of tetrabutyl titanate and modification of graphene oxide (GO) on the TiO2 doped shell. The use of graphene and doped TiO2 is a promising approach to provide photocatalytic activity under visible light and improve the microcapsules physicochemical properties. The morphology and chemical structure of the resulting microcapsule samples were determined by using Fourier transform infrared (FT-IR) spectroscopy, scanning electronic microscope (SEM), and X-ray diffractometer (XRD) methods. The ultraviolet, visible spectrophotometer (UV–vis), the differential scanning calorimeter (DSC) and the thermogravimetric analyzer (TGA) were used to investigate the absorption of visible and ultraviolet (UV), the thermal properties, and thermal stabilities of the microcapsules. Note that, the visible light photocatalytic activity was assessed for the toluene and benzene gaseous removal in a suitable test room. The microcapsules exhibit an interesting spherical morphology and an average diameter of 15 to 25 µm. The addition of graphene can enhance the rigidity of the shell and improve the microcapsules thermal reliability. At the same time, the thermal analysis tests showed that the synthesized microcapsules had a high solar thermal energy-storage and better thermal stability. In addition, the capric-stearic acid microcapsules exhibited high solar photocatalytic activity with respect to atmospheric pollutants under natural sunlight. The fatty acid samples obtained with the GO/TiO2 shell showed great potential for applications of solar energy storage, solar photocatalytic degradation of air pollutants and buildings energy conservation.

Keywords : thermal energy storage, microencapsulation, titanium dioxide, photocatalysis, graphene oxide
Conference Title : ICPCMB 2019 : International Conference on Phase Change Materials for Buildings
Conference Location : Tokyo, Japan
Conference Dates : June 10-11, 2019