Accepted Manuscript

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PII: S0266-3538(16)31928-5

DOI: 10.1016/j.compscitech.2017.03.001

Reference: CSTE 6684

To appear in: *Composites Science and Technology*

Received Date: 7 December 2016

Revised Date: 19 February 2017

Accepted Date: 1 March 2017

Please cite this article as: Liu Y, Liu M, Conductive carboxylated styrene butadiene rubber composites by incorporation of polypyrrole-wrapped halloysite nanotubes, *Composites Science and Technology* (2017), doi: 10.1016/j.compscitech.2017.03.001.

Conductive Carboxylated Styrene Butadiene Rubber Composites by Incorporation of Polypyrrole-Wrapped Halloysite Nanotubes

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Abstract

Polypyrrole-wrapped halloysite nanotubes (PPy@HNTs) are prepared by polymerization of pyrrole on the surfaces of HNTs. PPy@HNTs show improved dispersion ability and stability in water compared with pure PPy due to the increased zeta potential. The PPy@HNTs dispersions are compounded with carboxylated styrene-butadiene rubber (xSBR) latex to prepare conductive xSBR/PPy@HNTs composites. The morphology, conductive performance, mechanical properties, and swelling performance of the xSBR/PPy@HNTs composites are determined. PPy@HNTs can be uniformly dispersed in the rubber matrix and form a conductive network. The conductivity of the composites increases with the loading of PPy@HNTs. When the content of PPy@HNTs is 10%, the conductivity of the xSBR rubber increases to 1.82×10^{-4} s/m which is much higher than the corresponding xSBR/neat PPy composites (4.62×10^{-8} s/m). Also, the composites show significantly improved mechanical properties both in static and dynamic condition. The tensile strength, Young's modulus, and storage modulus of the composites are substantially higher than those of pure xSBR. The rigid filler networks effectively limit the mobility of rubber molecule chains,