Preparation of a Natural Rubber Nanocomposite Coating based on Fe₃O₄@Carbon materials and their Corrosion Resistance

Yan Wang¹, Yaya Zhou¹, YiBin Ma⁴, Hongbin Lu², Youyi Sun¹,²,*, GuiZhe Zhao¹, Yaqing Liu¹,²,*

¹ Shanxi Province Key Laboratory of Functional Nanocomposites, North University of China, Taiyuan 030051, China; ² State Key Laboratory of Molecular Engineering of Polymer, Fudan University, Shanghai 200433, China
*E-mail: syyi@pku.edu.cn, lyqzgz2010@163.com

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Fe₃O₄@carbon nanomaterials/natural rubber (NR) nanocomposite coatings were prepared via a latex compounding method, in which the carbon nanomaterials (e.g., reduced graphene oxide (rGO), graphene oxide (GO) and carbon nanotubes (CNTs) were efficiently dispersed in NR latex with the aid of Fe₃O₄ nanoparticles. Furthermore, the barrier properties of the various Fe₃O₄@carbon nanomaterials/NR nanocomposite coatings were studied and compared via electrochemical impedance spectroscopy, optical microscopy and potentiodynamic polarization. These results revealed that the Fe₃O₄@CNT/natural rubber nanocomposite coating was a better barrier against corrosive media compared with Fe₃O₄@GO or Fe₃O₄@rGO doped natural rubber coatings. Moreover, the Fe₃O₄@CNT/natural rubber nanocomposite coating maintained its high anticorrosive properties with a low Rrcco (ca. 5.2×10⁻⁴ mm/year) and Icorr (0.05 μA/cm²) over 10 cyclic bends (ca. 120⁰). Enhanced flexible anticorrosion performance was observed because the Fe₃O₄ growing on the carbon nanomaterials surface avoided carbon materials/metal connections, thus increasing the electrical resistance of the coating. Additionally, the as-prepared composite coatings were flexible and their structures were less disordered, which could greatly prolong the diffusion pathway of corrosive media in the coating matrix.

Keywords: Carbon nanomaterials; natural rubber latex; nanocomposites; latex compounding; anticorrosive properties.

FULL TEXT

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