Advances in Materials Research, *Vol.3, No.4 (2014) 233-242*
DOI: http://dx.doi.org/10.12989/amr.2014.3.4.233

Synthesis of conducting and magnetic nanocomposite of cross-linked aniline sulfide resin

Seyed Hossein Hosseini*

Department of Chemistry, *Faculty of Science*, *Islamic Azad University*, *Islamshahr Branch*, *Tehran-Iran*

(Received October 18, 2014, Revised December 10, 2014, Accepted December 30, 2014)

Abstract. Magnetic and conducting aniline sulfide resin cross-linked (ASC-Fe3O4) nanocomposite has been prepared in the presence of aniline sulfide resin (ASR), aniline, Fe_3O_4 coated by polyethylene glycol (PEG) and initiator. The magnetic properties of the resulting composites showed ferromagnetic behavior, such as high-saturated magnetization (Ms= 41 emu/g), and coercive force (Hc=1.5 Oe). The saturated magnetization was increased by increasing of Fe_3O_4 content and decreased by increasing aniline ratio. The transmission electron micrograph (TEM) and X-ray diffraction proved that nanometer-sized about 20-30 nm Fe_3O_4 in the composite. The average size of ASC-Fe_3O_4 nanocomposite with core-shell structure was about 50-60 nm, and polydisperse. This approach may also be extended to the synthesis and modification of other polymers. Electrical conductivity of aniline sulfide resin cross-linked (ASC) nanocomposite has been studied by four-point probe method and produced 3.3×10^{-4} S/cm conductivity for it. The conductivity of the composites at room temperature depended on the Fe_3O_4, aniline ratio and doping degree. The thermogravimetry analysis (TGA) results showed that this resin is thermal resistance near of 500 °C. So, It can be used for resistance thermal coating for military applications. Fe_3O_4-PASC nanocomposite has been flexible structure with electrical and magnetic properties.

Keywords: aniline-sulfide resin; magnetic; conducting polymer; nanocomposite

1. Introduction

Conducting polymers continue to be the focus of active research in diverse fields, including electronics, energy storage, catalysis, chemical sensing (Thomas *et al*. 2013 and Hosseini 2013).

Polyaniline is unique among conducting polymers in its wide range of electrical, electrochemical, and optical properties, as well as good stability (Hosseini *et al*. 2005). Polyaniline is typically synthesized by oxidizing aniline monomer either electrochemically or chemically (Hosseini *et al*. 2005). The most common strategy that has been implemented is to change the oxidizing agent employed in the chemical polymerization reaction. Magnetite (Fe_3O_4) is one of the famous magnetic materials in common use. Due to strong magnetic property and low toxicity, theirs applications in biotechnology and medicine has gained significant attention (Dresco *et al*. 1999). Many bioactive substances such as enzymes, proteins, antibodies, and anticancer agents

*Corresponding Author, Professor, Email: shhosseini@iiau.ac.ir

http://www.techno-press.org/?journal=amr&subpage=7 ISSN: 2234-0912 (Print), 2234-179X (Online)

Hosseini, S.H. (2013), "Studies of conductivity and sensing behavior of polyaniline grafted on polyvinylpropionate for pesticide poisons", *Synthesis and Reactivity in Inorganic, Metal-Organic, Nano-Metal Chem*., **43**, 852–860.

Hosseini, S.H. and Entezami, A.A. (2005), "Studies of thermal and electrical conductivity behaviors of polyaniline and polypyrrole blends", *Iranian Polym. J.* , **14**, 201-209.

Hosseini, S.H. and Ghavami, A. (2005), "Chemical and electrochemical synthesis polyvinyl propionate graft polyaniline", *Iranian Polym. J*., **14**, 617-626.

Dresco, P.A., Zaitsev, V.S., Gambino, R.J. and Chu, B. (1999), "Preparation and properties of magnetic and polymer magnetic nanoparticles", *Langmuir*, **15**, 1945-1951.

Tong, X.D., Xue, B. and Sun, Y. (2001), "A novel magnetic affinity support for protein adsorption and purification", *Biotechnol. Prog*., **17**, 134-139.

Chen, D.H. and Liao, M.H. (2002), "Preparation and characterization of YADH-bound magnetic nanoparticles", *J. Molecular Catalysis B*: Enzymatic, **16**, 283-291.

Wen, X.G., Wang, S.H., Ding, Y., Wang, Z.L. and Yang, S.H. (2005), "Controlled growth of large-area, uniform, vertically aligned arrays of alpha-Fe_2O_3 nanobelts and nanowires", *J. Phys. Chem. B* **109**, 215-220.

Zhong, L.S., Hu, J.S., Liang, H.P., Cao, A.M., Song, W.G. and Wan, L.J. (2006), "Self-assembled 3D flowerlike iron oxide nanostructures and their application in water treatment", *Adv. Mater*., **18**, 2426-2431.

Huang, F., Zhang, H.Z. and Banfield, J.F. (2003), "Two-stage crystal-growth kinetics observed during hydrothermal coarsening of nanocrystalline ZnS", *Nano Lett*., **3**, 373-378.

Raju, P. and Murthy, S.R. (2013), "Preparation of Ni–Zn ferrite nanocomposites using mechanical milling method", *Appl. Nanosci*., **3**, 469-475.

Hosseini, S.H., Moghimi, A. and Moloudi, M. (2014), "Magnetic, conductive, and microwave absorption properties of polythiophene nanofibers layered on $MnFe_2O_4/Fe_3O_4$ core–shell structures", *Mater. Sci. Semicond. Process*., **24**C, 272-277.

Deng, J., Ding, X., Zhang, W., Peng, Y., Wang, J. and Long, X. (2002), "Magnetic and conducting Fe_3O_4-cross-linked polyaniline nanoparticles with core-shell structure", *Polymer*, **43**, 2179-2184.

Hosseini S.H. and Asadnia A. (2012), "Synthesis, characterization, and microwave-absorbing properties of polypyrrole/$MnFe_2O_4$ Nanocomposite", *J. Nanomater*., **2012**, 1-6.

Hosseini, S.H., Malekdar, M. and Naghdi, S. (2010), "Chemical and electrochemical synthesis of cross-linked aniline sulfide resin", *Polymer. J*., **56**, 1-8.

Hosseini, S.H. and Sadeghi, M. (2014), "Investigation of microwave absorbing properties for magnetic nanofiber of polystyrene–polyvinylpyrrolidone", *Current Appl. Phys*., **14**, 928-931.