ELECTRODEPOSITED CONDUCTING POLYMER – FERROMAGNETIC COMPSITES

J.M. Ko*, D.-Y. Park, N.V. Myung and K. Nobe
Department of Chemical Engineering
University of California,
Los Angeles, CA 90095-1592

INTRODUCTION

Conjugated polymers have attracted considerable interest since the discovery of conducting polyacetylene in 1977 [1]. Since then, an enormous amount of work has gone into developing electronic and transport properties of conjugated polymers for various applications.

Among the various conducting polymers, polypyrrole (PPy) has a relatively high conductivity and remarkable stability [2]. It has been reported that PPy doped with dodecylsulfate (DS) anion, (PPy-DS), shows good mechanical properties and electrochemical stability [2-4]. In particular, when the PPy-DS is electrochemically reduced, DS anions are not removed from the bulk PPy film in electrolyte solutions due to their size. Instead of the elimination of DS anions, small cations such as Li^+, Na^+, K^+ are inserted into the bulk PPy film for charge neutralization.

In the present study, PPy/ferromagnetic binary and multilayers were electrodeposited, and their magnetic and electrical properties investigated.

EXPERIMENTAL

PPy films doped with dodecylsulfate, (PPy-DS), were prepared by electrochemical oxidation of pyrrole in aqueous solutions containing 0.36 M pyrrole monomer and 0.036 M NaDS as a supporting electrolyte [2]. PPy-DS was first electrochemically polymerized at 1 mA cm^{-2}. Then, magnetic materials (Co, Ni, NiFe, CoMnP) were electrodeposited at 0.5 mA cm^{-2}.

The magnetic properties and the microstructure of films were characterized using a vibrating sample magnetometer (VSM) and scanning electron microscopy (SEM), respectively.

RESULTS AND DISCUSSION

Figure 1 shows the surface morphologies of electrodeposited PPy-DS/ferromagnetic bilayer. Figure 1a shows a typical surface of electrodeposited PPy film with rough spherical grains. As the magnetic metal is electrodeposited on PPy, the surface morphologies change to a dendrite structure.

Figure 2 shows hysteresis loops of electrodeposited PPy-DS/Ni (a) and PPy-DS/CoMnP bilayer indicating both soft and hard magnetic composite films can be fabricated by selecting proper magnetic materials.

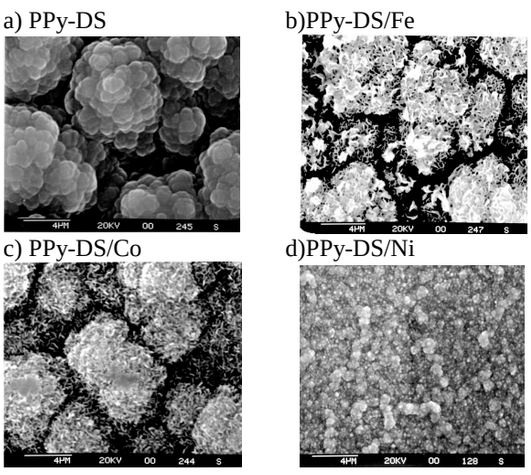

Figure 1. SEM micrographs of electrodeposited PPy-DS/magnetic bilayers.

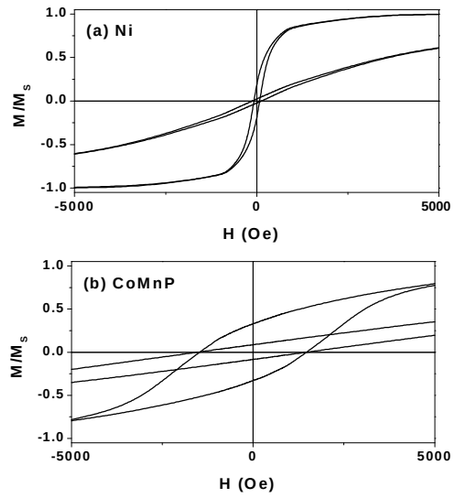

Figure 2. Hysteresis loops of electrodeposited (a) Ppy-DS/Ni and (b) Ppy-CoMnP films.

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