

Synthesis and characterization of polypyrrole-magnetite-vitamin B12 hybrid composite electrodes, Janaky C, Endrodi B, Hajdu A, Visy C, JOURNAL OF SOLID STATE ELECTROCHEMISTRY, 14 (2010) 339-346.

Abstract

In this study vitamin B12 covered magnetite nanoparticles have been incorporated into a conducting polypyrrole. This polymer was electrochemically synthesized in the presence of the B12-coated magnetite. The adsorption of B12 was demonstrated by the decrease in absorbance of the vitamin in the supernatant liquid after B12 has been in contact with magnetite sol overnight. The composition of the layers was studied by the electrochemical quartz crystal microbalance technique during the polymerization. The slope of the mass change-charge curves indicate the incorporation of 27 m/m% magnetite and 15 m/m% B12. The redox transformation of the film in monomer- and nanoparticle-free solutions was also investigated by this method and the difference in the virtual molar masses of the moving species was evidenced. The morphology and the composition of the layers were characterized by scanning electron microscopy combined with energy dispersive X-ray microanalysis measurements, which latter proved the successful incorporation of the magnetic and bio-active components. The electrochemical behavior of the films unambiguously showed the complex redox activity of the composites and the current surplus were quantified by the redox capacity of the layers. These data show the doubling of the redox capacity in case of the hybrid material compared to the neat polymer. The successful enrichment of B12 can be exploited in the recently evidenced redox mediation process performed by a PPy/B12 film.