PREPARATION OF CONDUCTING POLY(ACRYLONITRILE)/POLYPYRROLE COMPOSITES BY ELECTROCHEMICAL SYNTHESIS AND THEIR ELECTROCHEMICAL PROPERTIES

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Electrically conducting composite films were prepared by electrochemical polymerization of pyrrole in the insulating poly(acrylonitrile) matrix under various polymerization conditions and electrochemical properties of poly(acrylonitrile)/polypyrrole composites were studied. Electrochemical polymerization of pyrrole was performed by two methods; the potential cycling method using the function generator and the constant potential-applying method using the coulometer.

Pyrrole and counter-anion from supporting electrolyte can penetrate through the swollen poly(acrylonitrile) matrix(pre-coated on a Pt working electrode by spin coating) and polymerize on the Pt surface.

Electrochemical properties of poly(acrylonitrile)/polypyrrole composites and PPy films were also compared. Cyclic voltammograms showed that the growth rate of PPy in a poly(acrylonitrile) matrix was influenced by the polymerization conditions, e.g., type and concentration of the electrolyte, thickness of the poly(acrylonitrile) matrix film, anodic switching potential, polymerization time and temperature, etc..

Polymerization rate of pyrrole in the poly(acylonitrile) was inhibited for larger counter-anion, resulting in lower anodic current. Anodic peak current and peak potential were increased as the charge consumed during electrochemical polymerization was increased due to the increase of film thickness. The relationship of peak current and scan rate indicated that redox reactions of poly(acrylonitrile)/polypyrrole composites on Pt electrode were diffusion-controlled reactions.