ELECTROCHEMICAL BEHAVIOUR OF *PPY (DBS)* FILMS IN HIGHLY CONCENTRATED AQUEOUS *NaCl* ELECTROLYTES

M. J. M. JAFEEN, U. L. ZAINUDEEN, M. A. CAREEM

Department of Physics, Faculty of Science, University of Peradeniya

The electrochemical characteristics of PPy (DBS) films during the redox process significantly depends on many conditions, for instance, the type of counter ions and concentration of cycling electrolyte. Short cycle life in aqueous electrolytes limits the applications of PPy based conducting polymers in practical devices. Using ionic liquids as cycling media resolves the above problem to some extent; however the cost involved is prohibitive. The aim of this study was to investigate the possibility of using concentrated electrolytes to improve the cycle life of PPy/DBS film.

The electrochemical behaviour of polypyrrole films doped with large surfactant anion dodecyl benzene sulfonate, PPy (DBS), in highly concentrated NaCl aqueous solution (5 M) was investigated using Cyclic voltammetry, electrochemical microbalance (EQCM) and UV-visible absorption spectroscopy. The Films were prepared using the galvanostatic polymerization technique. For comparison, similar experiments were carried out in a dilute NaCl electrolyte having a concentration of 0.1 M. The EQCM studies showed that the mass change occurring in the film during the first cycle in 0.1 M electrolyte is comparatively higher than that observed in the 5 M electrolyte. This is because many water molecules go in and out of the polymer accompanying the counter ions, when PPy(DBS) film is cycled in dilute electrolytes, due to osmotic effect. On the other hand, during the redox process in the highly concentrated electrolytes the mass change is mainly due to moving counter ions since there is less amount of water present in the electrolyte. About 300 continuous cycles were carried out to test the cycling stability of PPy(DBS) films. Cyclic voltammgrams are almost unchanged after first few cycles up to about 50 cycles in both higher and lower concentrations. However, on further cycling, the shape and capacity of the cyclic voltammograms changed significantly in the dilute electrolyte while only a minor change was observed in the highly concentrated electrolyte indicating that the PPy(DBS) films have better cycle life in concentrated electrolytes. The optical absorption spectra obtained at various reduction potentials in both electrolytes look identical except for slightly larger peak absorbance in the 5 M electrolyte. This indicates that the PPy(DBS) films do not undergo any noticeable structural or conformational changes during the redox processes in dilute electrolytes in spite of considerable water movement taking place.

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