A STUDY OF REDOX MECHANISM OF POLYPYRROLE/ DODECYLBENZENESULFONATE POLYMER FILMS USING OPTICAL ABSORPTION AND CYCLIC VOLTAMMETRY.

Y.VELMURUGU[1], R.L.N. CHANDRAKANTHI[1], M.A. CAREEM[1], S. SKAARUP[2]

[1]*Department of Physics, University of Peradeniya, Peradeniya, Sri Lanka*
[2]*Department of Chemistry, Denmark Technical University, Dk-2800 Lyngby, Denmark.*

The properties of polypyrrole (PPy) are strongly influenced by the preparative and other conditions as well as the history of the polymer sample. The dependence of sample history is more prominent in the field of conducting polymers due to the complex nature of polymers when compared to crystalline solids. Therefore, in spite of the tremendous amount of work on conducting polymers, there still exist considerable differences among the results reported in the literature with regard to the properties of polymers.

In the present study, the doping of polypyrrole with large anionic detergent dodecylbenzenesulfonate (DBS) has been investigated using the optical spectroscopy and cyclic voltammetry. Reproducible voltammograms were only obtained after the completion of several potential cycles. The optical absorption spectra of the stable state of the film showed an energy gap of 3.05 eV corresponding to a strong $\pi \rightarrow \pi^*$ (band gap of neutral PPy/DBS film) transition in its reduced state. In conducting state, a broad absorption peak was present at 1.29 eV indicating the bipolaron formation during oxidation. In addition to this, a small shoulder was observed at around 2.2 eV corresponding to the polarons. These results indicate that bipolarons and polarons are the conducting species in PPy/DBS film. But the bipolarons seem to be the dominant species.

In addition to the above studies the PPy/DBS films were prepared using SDBS electrolytes having different concentrations to investigate the effect of micelle formation in the solution. The capacities of the cyclic voltammograms obtained for the films made with electrolyte concentrations above critical micelle concentration (CMC) value seemed larger than that of the films made with concentrations below the CMC value. Also in absorption spectra an intensity variation of the peaks and a small shift in isosbestic point with the variation of concentration of SDBS were observed.

We acknowledge the financial assistance from NSF, Sri Lanka and IPPS, Uppsala University, Sweden.