UV - Visible Optical Absorption Spectroscopic Studies on PEDOT and PPY Conducting Polymer Multilayer films

U.L. Zainudeen [1] * and M.A. Careem2

Department ofPhysical Sciences, South Eastern University ofSri Lanka.
Department ofPhysics, University ofPeradeniya, Sri Lanka.
Corresponding Author: ulzdeen@fas.seu.ac.lk

The energy gap of the conjugated polymer determines the intrinsic optical properties. The colour changes elicited by doping are due to the modification of the electronic band structure of the polymers. A polymer with a band gap in the UV range, is being transparent in its neutral state. When the polymer is doped, new electronic states in the band gap are induced and absorption of light in the visible range occurs. This means that the polymer becomes opaque, or heavily colored, upon doping. Accordingly, the UVVisible technique is crucial in studying the optical properties of conducting polymer.

Single and multi layer polymer films were formed galvanostatically on optically transparent ITO coated glass with poly(3,4-ethylenedioxythiophene) (PEDOT) and polypyrrole (PPy) . The active area of the ITO glass in contact with the solution was 3.14 cm-2 . The thickness of films corresponded to a charge of 40 mc cm-2 consumed during the film formation. The absorption spectra were measured in the range of 311-1100 nm (1.13 — 4.00 eV) with a UV-visible spectrometer during the oxidation and reduction of the films. An aqueous I M NaCl solution was used as the cycling electrolyte.

The two polymer PEDOT and PPy films show slightly different optical absorption behaviour. In the reduced state, while the PEDOT film has the main peak at 2.1 eV, the PPy film has it at 3.0 eV. These peaks which can be assigned to It-it electronic transitions correspond to the band gaps of the polymers. Thus, the PEDOT film appears to have lower band gap compared to that of the PPy film. The characteristic features in the spectra for both bilayer and trilayer films are a combination of the features from the spectra of the pure constituents. This means that these multilayer films behave like a combination of the pure components.

Key word: Conducting polymer, Uv-visible spectrometer, Band gap