STRUCTURAL AND OPTICAL CHARACTERISTICS OF SPIN-COATED POLY [(THIOPHENE-2,5-DIYL)-CO-(BENZYLIDENE)] PTB THIN FILMS AND THEIR PHOTOVOLTAIQUE APPLICATION

Y. Mouchaal[1*], A. L. Toumı[1], A. Reguıg Bendoukha[1], A. Khelıl[1] , J. C.Bernede[2]
[1]*Laboratoire de Physique des couches minces et matériaux pour l'électronique LPCM*[2]*E,Faculté des sciences, Université d'Oran Es-Senia, Algeria*
[2]*Laboratoire de chimie Organique, Macromoléculaire et des Matériaux (LCOMM), Université de Mascara, Faculté des Sciences et de la Technologie, Mascara, Algeria.*
[3]*LAMP, Université de Nantes, Nantes-Atlantique, Faculté des Sciences et des Techniques, Nantes, France.*
* younesdz@live.com

Abstract
In this work thin films of PTB polymer : poly [(thiophene-2,5-diyl)-co-(benzylidene)], which is soluble in various organic solvents such as CH_2Cl_2,$CHCl_3$ THF, acetone, and ethyl acetate were deposited onto glass substrates by spin-coating method, from a solution containing polymer powder and solvent with an appropriate concentration. After deposition, the films were heated at a temperature of 90°C in order to remove all traces of solvent and unwanted materials. Several polymer solutions of PTB with different solvent were prepared and deposited, the solvent giving the best morphological characteristic examined by Scanning Electron Microscope was chosen as the ideal solvent for the rest of our work. Optical and structural characteristics of the polymer thin films were studied using UV–vis spectroscopy, cyclic voltametric (CV) measurements, Fourier transform infrared absorption (FTIR) spectroscopy and x-ray analysis. SEM images showed that CH_2CL_2 is the best solvent for the PTB deposition by Spin Coating root. XRD patterns reported shows that our PTB films are amorphous because of the inexistence of crystalline peak. The spectrophotometric measurements of absorbance (A) and reflectance (R) spectra were carried out in the wavelength range 350–1200 nm. There are two main absorption bands: QI at about 445 and QII at about 445 nm. The energy levels corresponding to the highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO) of the PTB have been determined from the first oxidation and reduction potential respectively, using cyclic voltametric (CV) measurements [3,4]. From CV curves, PTB in dichloromethane showed a one electron reversible reduction and oxidation waves. The values of its HOMO and LUMO have been estimated to be 5.71 eV and 3.83 eV respectively. Such values show that PTB could be probed as a material donor in organic solar cells. The absorption properties of PTB and its low coast diposition make the material suitable for photovoltaic applications. For that organic solar cells made from bi-layer thin-film heterojunctions having PTB as an electron donor and C_{60} as an electron acceptor were investigated.

Keywords: PTB, Spin Coating, Optical properties, Thin Films, Organic Solar Cells