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ELECTROCHROMIC AND FLUORESCENT PROPERTIES OF A COPOLYMER BASED ON TERTHIOPHENE AND PYRROLE DERIVATIVE.

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Palavras Chave: *copolymer, electrochromism, fluorescence.*

Introduction

Conjugated conducting polymers presenting both electrochromic and fluorescent properties have become one of the main research topics due to their notable advantages, such as low cost and simple production methods, processability, and the possibility of tuning the band gap (and the colour states) of the polymer by suitable choice of the monomer substituent [1] or by copolymerisation [2].

Oligothiophenes, such as terthiophene (TTh), constitute an interesting class of electroactive polymers with potential application in organic electronics that can be used as components of active layers for application in electronic devices such as Organic Light Emitting Diodes (OLEDs) and electrochromic devices. In order to modify the properties of TTh, this work has focused on the electrochemical copolymerisation of TTh with a pyrrole derivative, (*R*)-(-)-3-(1-pyrrolyl)propyl-*N*-(3,5-dinitrobenzoyl)-α-phenylglycinate, DNBP. The polymer PDNBP has already been investigated by our group and presents good results concerning its application as an electrochromic material [3].

Results and Discussion

Poly(TTh-co-DNBP) films were electrodeposited onto ITO/glass by potentiodynamic ($0.00 \leq E \leq 0.73$ V *vs.* Ag/Ag^+) or potentiostatic (E = 0.80 V) methods using Pt as counter electrode and an Ag/Ag^+ (CH_3CN) electrode as reference in 0.1 mol L^{-1} $(C_4H_9)_4NBF_4/CH_3CN$. UV-vis-NIR spectra were acquired simultaneously to the cyclic voltammograms ($0.00 \leq E \leq 0.60$ V). *xy* chromaticity coordinates were acquired using a Microsoft® Excel® spreadsheet developed by Mortimer and Varley [4].

The spectroelectrochemical characterisation of the P(TTh-co-DNBP) is shown in Figure 1. The cyclic voltammogram of the copolymer film presents a broad redox couple with an anodic peak (E_{pa}) at 0.46 V and a cathodic peak (E_{pc}) at 0.30 V. Spectra of the copolymer film exhibited a band with λ_{max} at 448 nm in the neutral state (0.00 V). With increasing potential the peak intensity of this band decreases and is displaced to shorter wavelengths. It is possible to observe the formation of a new broad band in the NIR region (> 800 nm). The copolymer film is reddish orange (*x* = 0.480, *y* = 0.421) in the neutral state (E = 0.00 V) and greyish blue (x = 0.388, y = 0.400) in the oxidised state.

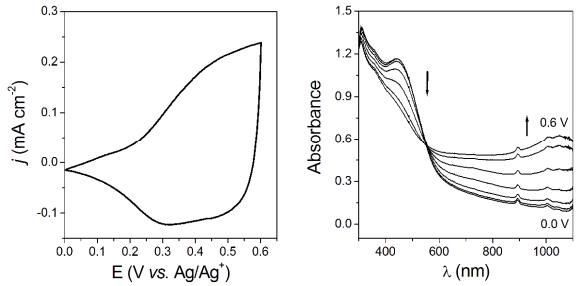

Figure 1. Spectroelectrochemical characterisation of P(TTh-co-DNBP) film, ν = 20 mV s^{-1}.

PTTh is a good light emitter (Figure 2) while PDNBP is not fluorescent, therefore the characterisation of the P(TTh-co-DNBP) films (or its solution) by fluorescence spectroscopy provides additional information about the formation of a copolymer.

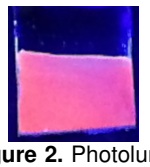

Figure 2. Photoluminescence of PTTh film under UV light.

Conclusions

Copolymerisation of TTh and DNBP leads to an interesting combination of the properties observed in the corresponding homopolymers and is an excellent tool for the fine-tuning of colour, as well as maintaining the fluorescence inherent to the PTTh.

Therefore, the combination of DHQT and DNBP make these structures useful for promising applications as electrochromic and fluorescent materials.

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