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# Electrochemical synthesis and characterisation of poly(3,4-ethylene dioxythiophene)/Dodecyl benzene sulfonate films in aqueous media

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Conducting polymers (CPs) such as polypyrrole (PPy), poly-N-methyl pyrrole (PNMP) and polyaniline (PANI) have been studied extensively by our group for a long period of time. It has been found that properties of these CPs depend significantly on the method of polymerization and on the conditions used during the synthesis. We report here our current studies on another CP, poly(3,4-ethylenedioxythiophene) (PEDOT) in conjunction with PPy in different configurations. Our ultimate goal is to explore the possibility of using bilayer or multilayer of these two polymers in artificial muscles.

PEDOT and PPy, each containing dodecyl benzenesulfonate (DBS) anions as immobile dopant species, were synthesised galvanostatically and characterised using cyclic voltammetry, absorption spectroscopy and electrochemical quartz crystal microbalance (EQCM) techniques. During the synthesis, PEDOT(DBS) films form at a higher potential than that of PPy(DBS) films. Cyclic voltammograms (CVs) of a PEDOT(DBS) film and a PPy(DBS) film under same cycling conditions are different in shape and size. While the CV of the PPy(DBS) film exhibits strong and well defined reduction and oxidation peaks, the PEDOT(DBS) has a capacitive-like current and two pairs of barely distinguishable redox peaks. For the PEDOT(DBS) film, the electrode mass change is small compared to that of the PPy(DBS) film during both cathodic and anodic parts of the cycle.

The two polymer films show slightly different optical absorption behaviour. In the reduced state, while the PEDOT(DBS) film has the main peak at 2.1 eV, the PPy(DBS) film has it at 3.0 eV. These peaks which can be assigned to $\pi$-$\pi^*$ electronic transitions correspond to the band gaps of the polymers. Thus, the PEDOT(DBS) film appears to have lower band gap compared to that of the PPy(DBS) film.

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