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POLYPYRROLE FILMS ON ALUMINIUM FROM ACID ELECTROLYTES: SYNTHESIS AND CHARACTERISATION

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The success in the generation of conducting polymer films on aluminium, applying relatively simple conditions and commercially available reactants, increases the possibilities for production of these materials on the industrial scale. Changing operational conditions of synthesis, accompanied by constant monitoring of the characteristics of the films, allows generation of polymer films with improved properties for use in particular applications (capacitors, rechargeable batteries, exchange membranes, corrosion protection, etc.). This study was concerned with the synthesis and characterisation of polypyrrole films on aluminium substrates. The process considered was electrochemical, where the polymerisation of the monomer in solution occurs directly on the metal surface, under anodic polarisation. Black, thick and relatively uniform polypyrrole films were deposited successfully on relatively pure aluminium from aqueous electrolytes comprised of pyrrole, toluenesulphonic acid and sodium athraquinonesulphonate. The polypyrrole films were characterised by scanning (SEM) and transmission electron microscopy (TEM), X-ray diffraction (XRD), Fourier-transform infrared (FTIR) and X-ray photoelectron (XPS) spectroscopy. Cyclic voltammetry was employed to characterise further the electrochemical behaviour of the polypyrrole-coated aluminium electrodes. Polypyrrole (PPY) films obtained from toluenosulphonic acid electrolyte were relatively brittle and powdery, and required increased times for complete coverage of the macroscopic surface of the electrode. The addition of anthraquinonesulphonate to this solution showed a synergistic effect, reducing the time for macroscopic coverage of the electrode by 90 %. The continuous growth of the polymer films during synthesis is evidence of their conducting nature. The films obtained revealed nodular morphologies, high levels of protonation, high degrees of disorder and electroactivity (doping-undoping capability) under polarisation in dilute potassium sulphate solution. As protective coatings against corrosion, the polypyrrole films failed to provide long-term protection for aluminium.