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Polypyrrole linear actuation tuned by phosphotungstic acid

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Research highlights

- Polyoxometalates in electropolymerization forming denser PPy films
- Linear actuators of PPy/DBS-PT showing significant increase in strain and stress
- The majority of PT stayed stably in PPy films during consecutive redox cycles

Abstract

Co-doping polypyrrole (PPy) with dodecylbenzenesulfonate and multicharged phosphotungstate anions (PT) from the phosphotungstic acid (PTA) led to free-standing PPy/DBS-PT films, which were studied for their linear actuation properties. FTIR and Raman spectra revealed that PT was successfully embedded in PPy/DBS during electropolymerisation. Isometric stress and isotonic strain measurements in aqueous electrolyte under various electrochemical experiments showed an increase in the obtainable strain and stress, which was attributed to the electrocatalytic role PTA plays during the electropolymerisation. This results in lower synthesis potential and the formation of more compact films in comparison to PPy/DBS films under equal conditions. With the improved structure as well as the higher-charged immobilized PT dopant, 17 times higher conductivities, 1.7 times higher redox charge, and 1.8 times higher specific capacitance were obtained (at equal frequency). Energy dispersive X-ray (EDX) spectra indicated that contrary to some other published works, the majority of PT stayed stably in the film during consecutive redox cycles.

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