

How functional are conducting polymer actuators? Some application attempts

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Polymers typified by polypyrrole, polyaniline, polyacetylene and polythiophene are normally semiconductor materials. When they are oxidised or doped electrochemically, they become conductors with conductivities as good as metals. Based on this principle, they can be synthesised in different composite structures such as bilayer structures or tri-layer structures in order to be employed as actuators, which simply convert electrochemical energy into mechanical energy through doping (oxidation) and undoping (reduction) of the polymer layers. With this in mind, in the last decade or so, significant efforts have been dedicated to their fabrication, analysis, performance optimisation, characterisation, modelling, and exploration of new application areas such as in robotic and biomimetic devices. The aims of these efforts have been to pave way towards their use in functional devices, in other words, to demonstrate that they can be useful actuators. In the University of Wollongong, we have been realising some research work along these aims. In this lecture, the results and implications of our experimental and analytical investigations into modelling, analysis and performance characterisation of these magic actuators (the ones working in air) will be presented and some of the devices we have established will be described with short video-footages showing their operation and performance.