E1-06: A smart cantilever using a conducting polymer: possible electrochemical muscle

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Some organic materials such as acetylene, pyrrole, thiophene etc., when polymerised with suitable anions in them, become electronically conducting with conductivities comparable to those of metals and these polymers are called conducting polymers.

The volume of the polymer changes when ions are inserted into or taken out of the polymer. Eventhough these volume changes are small, by choosing a suitable geometry, such changes can be utilised for sensing purposes.

In this study, bipolymer strips, composed of a polymer (polyethylene) layer and a conducting polymer (polypyrrole) layer, which can serve as a smart cantilever; are reported. The bipolymer strips were prepared by forming a thin layer of polypyrrole by electropolymerization on one side of a narrow strip of gold plated polyethylene sheet of thickness of about 100 μm. The electropolymerization was carried out in an aqueous solution of $LiClO_4$. When the bipolymer strips are placed in a solution containing suitable salts and a potential applied, the strips bend slowly in one direction like a cantilever. On reversing the potential, the strips bend in the opposite direction. This process can be repeated several times. The direction of bending depends on whether the conducting polymer concerned swells or shrinks when ions are inserted. Thus, such a polyethylene/polypyrrole bilayer can function as a smart cantilever, whose bending can be controlled by the applied voltage. Such strips could be employed in many applications such as sensors, actuators etc. They can also serve as electrochemical muscles.

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