Intelligent Materials and Carbon Nanotubes
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Intelligent or smart materials are under active investigation for their potential applications in health monitoring, space exploration, civil engineering, automotive, aerospace, textiles and the battlefield of the future. An intelligent material is defined as a material capable of recognising appropriate environmental stimuli, processing the information arising from the stimuli and responding to it in an appropriate manner and time frame. Intelligent materials differentiate themselves from conventional materials by their dynamic character, which allows them to respond autonomously to changing environmental conditions.

Combining polymers with carbon nanotubes could offer the enticing prospect of materials with enhanced functionality compared to polymers. Of particular interest are conducting electroactive polymers (CEP) such as the polyanilines, polypyrroles and polythiophenes which have been recognised as suitable building blocks for intelligent materials applications as they can be engineered to recognise stimuli, are conductive and can actuate.

However the properties of CEP are lower compared to the conductivity and current carrying capacity of most metals, mechanical properties of Kevlar and actuation stress of skeletal muscle. Hence there is room for improvement in the properties of electroactive polymers. This could be achieved by combination of these polymers with materials whose properties are superior to those of the polymers. Carbon nanotubes are an ideal candidate for such materials.

Carbon nanotubes have attracted enormous attention due to their phenomenal properties. For example, the mechanical and electrical properties of carbon nanotubes are several orders of magnitude higher compared to CEP such as the polyanilines. However, one of the main disadvantages of carbon nanotubes is their process-ability, i.e. they are not easily dispersed in most solvents due to their hydrophobic nature. This issue can be overcome by incorporating carbon nanotubes into a polymer material. This can result in composite materials with enhanced functionality.