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Editorial corner – a personal view
Smart polymer systems: a journey from imagination to applications

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Engineering materials are chosen for a given application mainly via their mechanical and physical properties, which constitute their behaviour at service. The term smart materials, refers to systems which are able to tune their behaviour responding to an external or internal stimulus. Certain properties of these systems can be varied in a controllable way, such as stiffness, shape, damping capacity, natural vibration frequency, polarization, conductivity, energy storing efficiency etc. Smart structures are usually material systems incorporating functional constituents that are able to perform the operations of sensing, actuation and control. The smart behaviour of the whole system is induced by the large changes in amplitude of specific properties of the functional constituents, responding in real time to an imposed stimulus. Typical examples of smart systems' components are: piezo/ferroelectrics, electro/magnetostrictive materials, electro/magnetorheological fluids, thrermoresponsive materials, shape memory materials, electrochromic materials, nanodielectrics and others. Polymers and fibre reinforced polymers are considered as suitable candidates for providing the requisite structure in which functional parts could be embedded. Initial efforts carried out more than 20 years ago met criticism. Polymer composites incorporating shape memory alloys in the form of ribbons or wires represent a characteristic example, in which the dynamic response of the system as well as its shape can be controlled, giving new frontiers in the automotive and aerospace industry. Shape memory alloys and polymer gels exhibit biomechanical and biomedical applications in developing artificial muscles and devices for active control of in-vivo drug-delivery. Piezopolymers are used as infrared sensors and smart skins in comfort control systems. On the other hand the distribution of dielectric inorganic nanoparticles within a polymer matrix offers new possibilities in energy storing devices. This type of materials is tested for power systems in applications such as mobile electronic devices and hybrid electric vehicles. Further applications of polymer matrix-inorganic particles nanocomposites include passive protection, acoustic emission sensors and self-current regulators. Since the driving force for the evolution of new materials is to fulfill the technological requirements of the continuously increasing social demands, and the methodology of developing smart materials follows bio-mimetic criteria, the field of smart polymer systems appears to be wide open and very promising.

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