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Shape-memory polymers for multiple applications in the materials world

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Abstract

Shape-memory polymers (SMPs) as stimuli-responsive shape-changing polymers are of great interest for fundamental research and technological innovation. In this contribution, a brief review of the recent trends in the field of SMPs is presented with particular focus on their structure, shape-memory effects and working mechanism. A special attention is paid to smart multi-responsive and multi-functional SMP materials as emerging technological class. They are mainly described as shape-memory nanocomposites (SMCs) where the incorporation of functional (in)organic nanofillers in the SMP matrices is purposely carried out. Potential applications of the SMCs-based materials as medical and biomimetic devices, self-healing systems, self-deployable structures, actuators, sensors etc. or their direct implementation in the industry are finally outlined.

Keywords: shape-memory polymer, shape-memory composites, nanofiller, multi-functional, multi-responsive

1) Introduction

An emerging class of new materials is the so-called “shape-memory” composites including shape-memory polymers (SMPs), alloys, hybrids, ceramics and gels. The main focus for the moment falls on SMPs due to a multitude of desirable qualities: low density, potentially recyclable at relatively low cost, high recoverable strain within a wide range of stimuli, transparency, chemical stability and modification, easier processing, biocompatibility and biodegradability with an opportunity to adjust the degradation rate [1]. SMPs also happen to be

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