Express Polymer Letters Vol.17, No.7 (2023) 674
Available online at www.expresspolymlett.com
https://doi.org/10.3144/expresspolymlett.2023.49

Editorial corner – a personal view

Shape memory polymers: Current state and future prospects

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Shape memory polymers (SMPs) are intelligent materials capable of changing shape in response to external stimuli, such as heat, light, or a magnetic field. SMPs have attracted significant attention in recent years due to their unique properties and potential applications in various areas, *e.g.*, in the biomedical, aerospace, and the electronics industry (https://doi.org/10.3144/expresspolymlett.2022.66). The concept of shape memory was first discovered in the 1940s in metallic alloys, but it was not until the 1980s that the first SMPs were developed with the use of synthetic polymers. Early SMPs were limited in their applicability due to their high glass transition temperature and poor mechanical properties. However, new generations of SMPs with improved performance and functionality have been developed with the advancement of materials science and technology.

Currently, there are three main types of SMPs: thermoplastic, thermoset, and elastomeric SMPs. Thermoplastic SMPs are the most commonly used and are characterized by their high elasticity, processability, and excellent shape memory properties. Thermoset SMPs offer excellent mechanical properties and thermal stability. They are usually synthesized by crosslinking the polymer chains, such as in epoxy or phenolic resins. Elastomeric SMPs are highly stretchable and have excellent shape memory properties. They are typically a blend made from rubbers, *e.g.*, polyisoprene and polybutadiene, or can be thermoplastic elastomers (https://doi.org/10.1002/adma.202000713).

SMPs face diverse challenges in different fields. In biomedicine, new SMP materials are needed that are non-toxic and biocompatible, as well as new activation methods that respond to the human body. In aerospace engineering, the load-bearing capacity of SMPs has to be increased so that they can replace more mechanical parts. Consistent repetition and multiple-shape and two-way shape memory polymers are now in demand in electronics. Researchers are currently exploring different methods to meet these demands, such as incorporating functional groups and nanofillers (https://doi.org/10.3144/expresspolymlett.2021.37). Another challenge is the limited range of stimuli that can trigger the shape memory effect. Most SMPs currently require a temperature change to trigger the shape memory effect. However, researchers are exploring new ways to trigger the shape memory effect, such as using light or a magnetic field. By developing SMPs that can respond to a wider range of stimuli, researchers can significantly broaden the potential applications of these materials (https://doi.org/10.3390/polym14173511).

In conclusion, SMPs have come a long way since their discovery in the 1980s. They offer unique properties and potential applications in various fields. Developing new generations of SMPs with improved performance and functionality is an active area of research. Researchers are also exploring ways to address the challenges of achieving a stable and repeatable shape memory effect and extending the range of stimuli that can trigger the effect. With continued research and development, SMPs have the potential to revolutionize materials science and engineering.

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