

Investigation on recycling and reprocessing ability of self-healing natural rubber based on ionic crosslink network

Abstract

Natural rubber (NR) is a complex material that is often discarded due to its three-dimensional structure. Recycling of rubber is difficult due to its complex structure, and only 1.7 million tonnes of waste, such as tyres and gloves, are considered recyclable. This study aims to develop self-healing rubber, which allows a product to recover without affecting structural reliability. Commercial NR was ionically crosslinked with zinc thiolate, forming an ionic crosslink network between rubber chains and zinc thiolate ions. The ionic crosslinks allow the rearrangement of rubber molecular chains under external heat, providing self-healing capabilities. The highest ionic crosslink density was found in NR with 35 phr zinc thiolate. The self-healing NR can recover 90 % of its initial properties at room temperature for 10 min and can be reprocessed and recycled three times without compromising its properties. It also shows excellent weldability, making it a promising material for repairing existing rubber products in heavy engineering applications.

Keywords

Advanced materials for environmental protection; Ionic cross-link; Natural rubber; recycle; Self-healing