A fast water-induced shape memory polymer based on hydroxyethyl cellulose/ graphene oxide composites

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A fast water-induced shape memory polymer based on hydroxyethyl cellulose/ graphene oxide composites

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Abstract

Herein, a fast water responsive shape memory polymer composites based on hydroxyethyl cellulose (HEC) has been fabricated by crosslinking with graphene oxide (GO) and citric acid (CA). The swelling behavior, mechanical properties, micro-topography, thermal stability, as well as water and moisture induced shape memory performance of this composite were all fully investigated to demonstrate its functions. After crosslinking with GO and CA, the composite exhibited excellent mechanical properties with tensile strength over 100 MPa, which was nearly 4 times higher than pure HEC. Moreover, the pre-deformed composite was able to fully recover to its original shape in aqueous environment, which not only quickly happened in water (14 s), but also occurred in wet air with relative humidity about 70 within only 5 min. With such outstanding properties, we envisage that this composite could play a significant role in developing new generations of water responsive sensors, actuators and biomedical devices.

Keywords: A. Cellulose; A. Polymer-matrix composites (PMCs); A. Smart materials; B. Mechanical properties.

1. Introduction

Smart materials with fast, reversible and controllable shape changes in response to external stimuli have gained increasing attention due to their remarkable potential in many application fields, such as robots, sensors, smart sutures and aerospace industry [1,2]. Among these smart materials, one material that has emerged as a