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On the near-infrared light-responsive and mechanical properties of PNIPAM-based nanocomposite hydrogels

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Abstract

Smart near-infrared (NIR) light-responsive poly N-isopropylacrylamide (PNIPAM) nanocomposite hydrogels were prepared by incorporating sparse chemical cross-linking of small molecules. The thermo-sensitive, NIR light-responsive, toughness and strength of the pure PNIPAM, PNIPAM-Graphene oxide(GO) and PNIPAM-GO-Zirconia(ZrO_2) hydrogels were invesitgated. The introduction of GO induced PNIPAM the transformation from the thermosensitive to NIR light-responsive, and the oxidized groups of GO nanosheets could physically cross-link the PNIPAM chains to increase the toughness of the hydrogel networks. The loading capability and penetration resistance of PNIPAM-GO-ZrO_2 composite hydrogel was obviously improved due to that the ZrO_2 powder stabilize the hydrogel networks and strengthen the hydrogen bond interaction with the amide groups of PNIPAM chains compared with that of the pure PNIPAM and PNIPAM-GO, respectively.

Keywords: Hydrogels; Composite materials; NIR light-responsive; Toughness; Strength

1 Introduction

As one type of two-dimensional (2-D) nanostructured sp^2 car-bon material, graphene showed perfect optical, electrical and mechanical properties[1]. Therefore, graphene or GO showed promising applications. Smart hydrogels are three-dimensional networks composed of cross-linked hydrophilic polymer chains[2]. Considerable attention has been focused on smart hydrogels that exhibit reversible

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