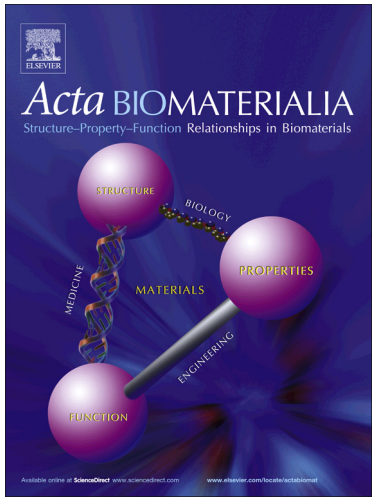

Full length article

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Mechanically Enhanced Nested-Network Hydrogels as a Coating Material for Biomedical Devices

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Abstract:
Well-organized composite formations such as hierarchical nested-network (NN) structure in bone tissue and reticular connective tissue present remarkable mechanical strength and play a crucial role in achieving physical and biological functions for living organisms. Inspired by these delicate microstructures in nature, an analogous scaffold of double network hydrogel was fabricated by creating a poly(2-hydroxyethyl methacrylate) (pHEMA) network in the porous structure of alginate hydrogels. The resulting hydrogel possessed hierarchical NN structure and showed significantly improved mechanical strength but still maintained high elasticity comparable to soft tissues due to a mutual strengthening effect between the two networks. The tough hydrogel is also self-lubricated, exhibiting a surface friction coefficient comparable with polydimethylsiloxane (PDMS) substrates lubricated by a commercial aqueous lubricant (K-Y Jelly) and other low surface friction hydrogels. Additional properties of this hydrogel include high hydrophilicity, good biocompatibility, tunable cell adhesion and bacterial resistance after incorporation of silver nanoparticles. Firm bonding of the hydrogel on silicone substrates could be achieved through facile chemical modification, thus enabling the use of this hydrogel as a versatile coating material for biomedical applications.

Keywords: Hydrogel, Alginate, Coating, Biomedical device, Nested-network

1. Introduction

Hydrogels are a class of polymeric materials widely employed to mimic physical and chemical properties of biological tissues for biomedical applications such as ophthalmology [1-3], cosmetics [4], orthopaedics [5], medical devices [6,7], drug delivery [8-10] and tissue reconstruction [11-13]. This is attributed to their common merits including high equilibrium