URN etd-0407109-183708-544
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Author's Email Address No Public.
Statistics This thesis had been viewed 65 times. Download 21 times.
Department
Year 2006
Semester 2
Degree Master
Type of Document Master's Thesis
Language zh-TW.Big5 Chinese
Title Investigation of PAA-Alg-Si Hydrogel Mechanical Properties under Uniaxial and Biaxial Load
Date of Defense 0000-00-00
Page Count 80

Keyword
hydrogel
uniaxial tensile test
biaxial tensile test
hyperelasticity

Abstract
Articular cartilage is a highly organized avascular tissue and could be injured as a result of sports related trauma. It has very limited capacity for repair due to its avascular nature. Medical treatments for injured articular cartilage are required in many circumstances. Hydrogels have inherently weak mechanical strength. However, the advantages of bio-compatibility and hydrophilicity make hydrogels become biomaterials for many medical applications. Recent advances in the development of high strength hydrogels for new load-bearing medical applications such as repair of damaged articular cartilage necessitate the mechanical properties investigation of these hydrogels. Developing suitable constitutive equations for hydrogels is also important for these applications. In this research, mechanical properties, under tensile load, of new developed UV polymerized Poly acrylic acid-Alginate-Silica (PAA-Alg-Si) hydrogels with different weight percentages of PAA (3% and 5%) and Silica (0%, 3%, 6%, 9%, 12% and 16%) were investigated. These hydrogels have potential for repairing the damaged articular cartilage due to its low friction and high mechanical strength. Mechanical properties of hydrogels were investigated under uniaxial and biaxial load. The experiments were performed with a loading displacement rate of 0.2mm/sec. It can be seen from the stress-strain relations of these hydrogels that the mechanical properties of PAA-Alg-Si hydrogels are strongly dependent on the weight percentages of Silica and PAA in PAA-Alg-Si hydrogels. Furthermore the uniaxial and biaxial stress-strain relations of aforementioned hydrogels were fitted to hyperelastic constitutive models. Good agreements between experiment/numerial/analytical results were obtained. It can be seen that the imcompressible hyperelastic models is suitable for these hydrogels.
Advisory Committee Nai-Shang lious - advisor

Files etd-0407109-183708-544-001.pdf

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Date of Submission 2007-07-16