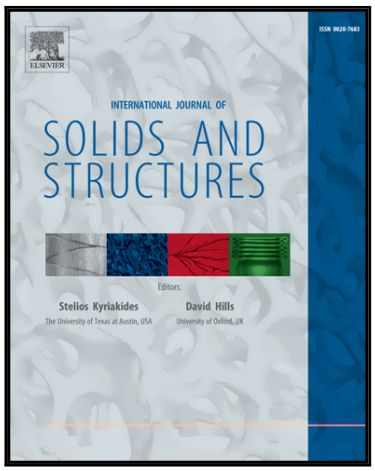

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Phase-field model for liquid-solid phase transition of physical hydrogel in an ionized environment subject to electro-chemo-thermo-mechanical coupled field

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Keywords: mobile ionic species; phase-field model; electro-chemo-thermo-mechanical coupled field; liquid-solid phase transition; physical hydrogel

Abstract

In this paper, a phase-field model is developed for simulation of the phase transition of physical hydrogels between the liquid solution and solid gel states in an ionized environment, subject to an externally applied electro-chemo-thermo-mechanical multiphysics coupled field. The presently developed model consists of the governing equations for the equilibrium of forces, the conservations of energy and mass, and the Maxwell's equations. Based on the second law of thermodynamics, the constitutive equations are formulated from the entropy viewpoint, including a novel Ginzburg-Landau type of free energy with the effect of crosslink density, which may be reduced to that for a chemical hydrogel if a constant crosslink density is considered. In order to identify the phases for the present domain covering the gel and solution states, the crosslink

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