

THERMO-ELECTRO-CHEMO-MECHANICAL COUPLING

PROBLEMS OF SMART SOFT MATERIALS

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Abstract This paper mainly presents a review of the multi-field coupled mechanical questions in typical smart soft materials including polymer gel and hydrogel as well as articular cartilage widely distributed in nature. Based on phenomenological thermodynamics theory and Hamilton principle, a general thermo-electro-chemo-mechanical coupling theory is established. Focusing on chemo-mechanical constitutive laws and governing equations, the finite element formulation of chemo-mechanical coupled systems is derived from Hamilton principle and its closeness is proved. A several numerical examples are considered to analyze the multi-field coupled phenomena of hydrogel and articular cartilage. Finally, future trends in multi-field couplings for smart soft materials are identified.

Key words: smart soft materials, thermo-electro-chemo-mechanical coupling, chemo-mechanical coupling, constitutive law, Hamilton principle , finite element method