

The Department of Mechanical Engineering/College of Engineering and Applied Sciences
Stony Brook University

Mechanical Engineering Seminar



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Lecture Title: Mechanics of Polyelectrolyte Gels

Friday, October 30, 2009, 11:00 AM, Room 173 Light Engineering

Abstract

Immersed in an ionic solution, a network of polyelectrolyte polymers imbibes the solution and swells, resulting in a polyelectrolyte gel. The swelling is reversible, and is regulated by ionic concentrations, mechanical forces, and electric potentials. A field theory is developed to couple large deformation and electrochemistry in polyelectrolyte gels. A specific material model is described, including the effects of stretching the network, mixing the polymers with the solvent and ions, and polarizing the gel. We show that the notion of osmotic pressure in a gel has no experimental significance in general, but acquires a physical interpretation within the specific material model. The theory is used to analyze several phenomena: a gel swells freely in an ionic solution, a gel swells under a constraint, electric double layer at the interface between the gel and the external solution, and swelling of pH-sensitive gels.

Biography

Wei Hong is a solid mechanician who is interested in things that are not so solid – soft active materials and smart structures – materials or structures that will respond to external stimuli. As a modeler, he is interested in how the materials and structures behave and why they are “smart”. Wei did his undergraduate and his master’s degree in Tsinghua University at Beijing, China, and he got his PhD degree from Harvard University in May 2006, concentrating on the microstructure evolution of solid surfaces. After two years of postdoctoral research on smart materials, in 2008, he started his career in Iowa State University as an assistant professor in the departments of aerospace engineering and materials science and engineering.

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