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Modeling Discontinuous Phase Transitions in Gel Membranes: Focus on Hysteresis and Feedback Mechanisms OLGA KUKSENOK, Clemson Univ — Feedback mechanisms are vital in a number of processes in biological systems. For example, feedback loops play an essential role during a limb development in mammals and are responsible for the asymmetric cell division to constrain the growth in plants to the specific regions. An integration of well-controlled feedback loops into the fully synthetic materials is an important step in designing a range of biomimetic functionalities. Herein, we focus on hydrogels functionalized with light-sensitive trisodium salt of copper chlorophyllin and study discontinuous phase transitions in these systems. Prior experimental studies had shown that illumination of these functionalized gels results in their heating and in discontinuous, first order phase transition upon the variation in temperature. Herein, we develop the first computational model for these gels; the framework of the model is based on the gel Lattice Spring Model, in this work we account for the gel heating under the illumination. The results of our simulations are in a good agreement with prior experimental studies. We focus on pattern development during the volume phase transitions in membranes of various thicknesses and show that one can effectively utilize light intensity to remotely control feedback loops in these systems.

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