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Effect of Confinement on the Dynamics of Three-Dimensional Chemo-responsive Gels OLGA KUKSENOK, VICTOR V. YASHIN, ANNA C. BALAZS, Chemical Engineering Department, University of Pittsburgh — Chemo-responsive gels undergoing the Belousov-Zhabotinsky(BZ) reaction could be ideal candidates for creating materials that can perform sustained mechanical work. We use theory and simulation to investigate the behavior of three-dimensional samples of BZ gels that are spatially confined in various geometric arrangements and show that the spatial confinement has a dramatic effect on the samples' dynamics. We first perform a linear stability analysis in two limiting cases, where a small sample is either completely free or attached at all the boundaries to fixed, hard walls. We find the critical reaction parameters at which the gels undergo a transition from a stationary steady state to an oscillatory regime in each of these cases. We then carry out corresponding computer simulations using our 3D gel lattice spring model and find an excellent agreement between the theory and simulations. Furthermore, we illustrate that the above analysis allows us to predict the behavior of larger samples that are confined in more complex spatial arrangements.

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