Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Buckling of swelling gels under constraints HOWON LEE, University of Illinois at Urbana-Champaign, JIAPING ZHANG, YONGHAO AN, HANQING JIANG, Arizona State University, NICHOLAS FANG, Massachusetts Institute of Technology — Buckling is a traditional topic in mechanics and has been thought to be well studied for the last hundred years. Recently, buckling has drawn new attention in a different perspective; a novel scheme for pattern transformation. Here we present an experimental study on buckling using swelling of gels under constraints. Under critical conditions combined with proper mechanical constraints, non-homogenous stress develops as gel swells, which gives rise to buckling instability. We developed a fabrication technique to make a 3D cylinder-shaped microgel, the bottom end of which is tightly fixed on a rigid substrate to impose constraints. Equilibrium swelling study of such gel structure allowed us to determine a critical geometrical condition for buckling. Furthermore, exploiting slow gel swelling process, we recorded time evolution of buckling as gel swells to study post-buckling morphologies. Numerical simulation also showed close relationship between geometric parameters and resulting buckling pattern. We believe our study on buckling of swelling gels will not only help us better understand the mechanics of soft materials, but it will also contribute to increasing the breadth of possible application of soft materials in many emerging fields such as photonic crystals.

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Date submitted: 19 Nov 2010 Electronic form version 1.4