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Swelling-induced surface instabilities in growing poroelastic polymer networks MATTHEW G. HENNESSY, Imperial College London, ALESSANDRA VITALE, Politecnico di Torino, JOAO T. CABRAL, OMAR K. MATAR, Imperial College London — The swelling that occurs when a deformable polymer network absorbs solvent can generate large compressive stresses which, in turn, can lead to a rich variety of surface instabilities. In this talk, we will discuss recent experiments by our group which suggest that the growth of a polymer network by photopolymerisation and the onset of swelling-induced surface instabilities can simultaneously occur and drive the self-assembly of complex three-dimensional structures. In addition, we will present a theoretical model of photopolymersation that captures the growth, swelling, and mechanical response of the polymer network. The model is based on an Eulerian formulation of nonlinear poroelasticity. The transport of monomer is described by a generalisation of Darcy's law that accounts for flow due to gradients in the pressure and composition. A combination of asymptotic analysis and finite-element simulations is used to explore the coupling between growth and instability as well as the resulting surface morphologies.

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