Deformation of Unentangled Swollen Gels OZAN SARIYER, The University of North Carolina at Chapel Hill, SERGEY PANYUKOV, P. N. Lebedev Physics Institute, Russian Academy of Sciences, MICHAEL RUBINSTEIN, The University of North Carolina at Chapel Hill — We study the deformation characteristics (Poisson's ratios and stress-strain relations) of unentangled gels swollen and uniaxially or biaxially deformed in excess solvent by considering the balance of osmotic pressure and elastic stress in unconstrained dimensions. Our scaling theory predicts a crossover from theta solvent behavior to marginal solvent behavior upon stretching gels that are in concentrated regime at swelling equilibrium – a phenomenon that was experimentally observed long ago, but not understood theoretically. For gels that are in the semidilute good solvent regime at swelling equilibrium, we predict a crossover to theta solvent behavior upon compression and a crossover to marginal solvent behavior upon stretching. Our theory reproduces the previously known results for equilibrium swelling degree as well as known deformation characteristics in theta and athermal solvents.

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