Abstract Submitted
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Non-affine deformations in flexible and semi-flexible polymer gels[1] ANINDITA BASU, Physics and Astronomy, University of Pennsylvania, QI WEN, Institute for Medicine and Engineering, University of Pennsylvania, XIAOMING MAO, TOM LUBENSKY, Physics and Astronomy, University of Pennsylvania, PAUL JANMEY, Institute for Medicine and Engineering; Physics and Astronomy, University of Pennsylvania, ARJUN YODH, Physics and Astronomy, University of Pennsylvania — We test the validity of affine deformation assumption in flexible and semi-flexible polymer networks by embedding different-sized fluorescent tracer beads within model polymer networks and quantifying their displacements under shear. A conventional rheometer is used with a confocal microscope for this purpose. Non-affinity is quantified as a function of applied strain, polymer chain density, cross-link concentration, network morphology, reaction kinetics and size of probe particles used. Non-affinity measurements in flexible polymer gels are in qualitative agreement with current theories in rubber elasticity. For semi-flexible bio-polymer gels, measurements indicate that non-affine deformations are small for networks of thinner, relatively flexible filaments and get smaller as strain increases into non-linear elastic regime. These small measures are consistent with the entropic model for non-linear elasticity of semi-flexible gels. However, as filament stiffness and mesh size increase, the deformations become more non-affine, as predicted by the enthalpic bending and stretching models of non-linear elasticity.

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