From Brownian Motion to Measuring Viscoelasticity : A Study on the Elasticity of PolyPeptide Nanogels via Microrheology

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Polypeptides are macromolecules that have been used in various applications in regenerative medicine, drug delivery, biomimetic-bioinspired materials and supramolecular chemistry research fields. When the self-assembled peptide nanofiber gel network are used as extracellular matrix in biomedical applications, the viscoelastic properties of the gel network need to be known and controlled precisely so that the gel matrix can support the growing cells and tissues. The commercial rheometers can only measure the averaged viscoelastic value of a gel network, where local viscoelasticity information is lost. On the other hand, microrheology technique measures not only the averaged but also the local viscoelastic properties of a material. In this study, we measure the viscoelasticity of a novel peptide nanofiber gel network by microrheology technique via using a fluorescent video microscope. We used positively and negatively charged colloidal particles in separate experiments to investigate the possible specific interactions between the colloidal particles and the gel network. The complex modulus values of the system are found to be comparable with the ones of similar polymeric systems. We also found that the local behavior of the gel yields heterogeneous properties and the specific interactions are important in the peptide nanofiber gel system. In this presentation, we will lay out the basic steps of this technique such as measuring Brownian motion of particles via image analysis and calculating viscoelasticity of the medium from the raw data.

Keywords: Microrheology, peptide nanofiber gels, video microscopy, colloidal particles, soft matter physics.

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