New Rheometric Measurement Technique for Biological Samples

TITLE

Methods and Systems for Viscoelastic Characterization of Irregularly Shaped Anisotropic Biological Samples

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PATENT STATUS:

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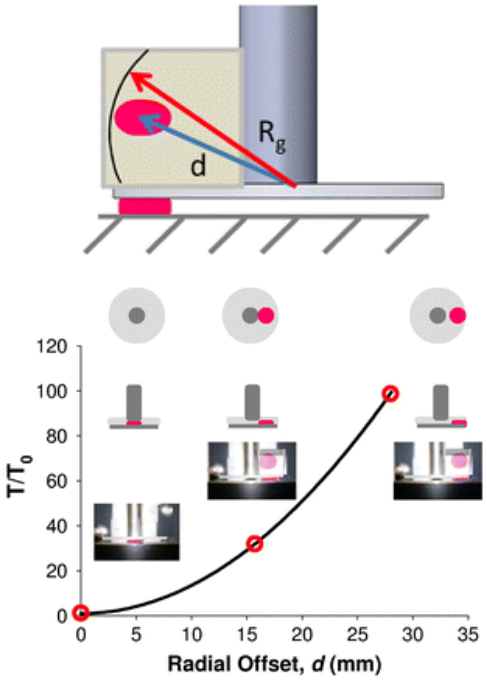
Eccentric Viscoelastic Rheometry



*The amount of torque that the sample generates increases as the distance, **d** from the axis of rotation to the centroid of the sample increases in relation to the radius of the disc, R_g. The plot above shows the increase in ratio of measured torques for a sample as it is moved from the center to the edge. This offset results in ~100-fold increase in torque relative to the centered configuration for a given angular displacement*

BACKGROUND

Quantification of the viscoelastic properties of soft tissue biopsies and fibrous protein gels is vital to the understanding of normal tissue development, wound healing, disease progression, and cell-mediated remodeling engineered tissues. Rheometers are well suited for characterizing the storage and loss modulus of such soft gels; however, standard geometries used in existing commercial instruments require relatively large, homogeneous samples to generate sufficient torque for accurate analysis of low stiffness materials. Additionally, the analysis generally assumes isotropic linear viscoelastic behavior. Newly formed tissues and biological protein gels such as blood clots are often small, soft, irregularly shaped, anisotropic, and difficult to handle. Rheometry of tissue samples and other biological samples, such that the results of biopsies, is not commonly measured since the samples are incompatible with the conventional rheometers. Accurate and sensitive viscoelastic characterization of small, irregularly shaped biological samples requires an extension to conventional rotational rheometry.

ADVANTAGES

- Ability to analyze irregular shapes and anisotropic materials
- Ability to analyze soft tissue and fibrous protein gels
- Reduction in sample volume used

SUMMARY

- Eccentric viscoelastic rheometry extends the utility of standard rotational rheometers for accurate and sensitive viscoelastic characterization of small, irregularly shaped, or anisotropic samples and systems.
- The sample is radially offset from the center of a sample holding section of a conventional parallel plate rotational rheometer. Imaging may be used to obtain geometrical and location properties of the sample, a polar moment of inertia for the sample and a complex modulus of elasticity for the sample.

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