Magnetic wire microrheology to differentiate viscoelastic liquids from yield stress gels

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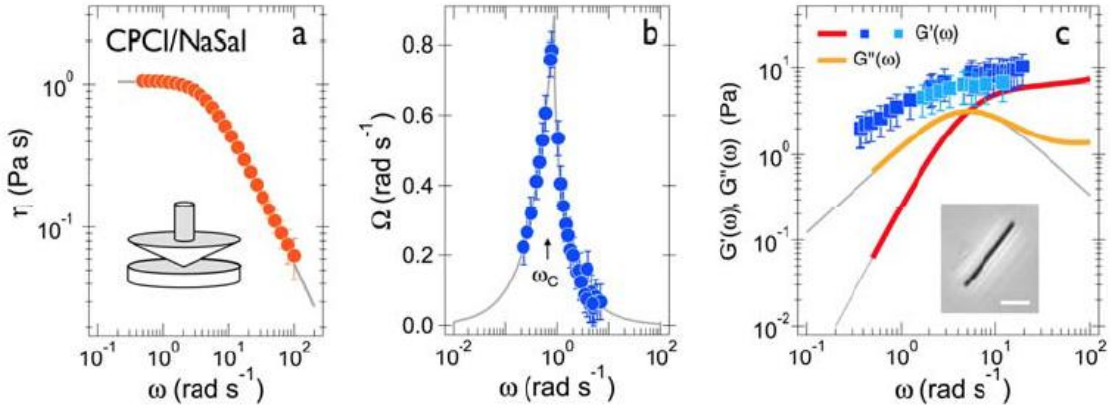
Magnetic rotational spectroscopy using superparamagnetic wires, made of iron oxide nanoparticles, is used to have a rapid and accurate determination of the rheological behavior of viscoelastic liquids or gels. Model solutions were investigated including micellar surfactant solutions and polysaccharide gels to assess the reliability of this technique by comparing experimental results with the Maxwell and Kelvin-Voigt models. Important experimental parameters when investigating the wire rotation behavior submitted to a magnetic field and using optical microscopy allows to relate the frequency dependence of the wire motion to the rheological properties. In particular, synchronous and asynchronous regimes, critical frequency, amplitude of the oscillation and wires average rotation speed were measured and found in good agreement with theoretical models [1-3].



Linear and microrheology measurements of micellar like surfactant solutions. Experimental data obtained by magnetic rotational rheology were found in good agreement with linear rheology and theoretical model.

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[2] L. Chevry, N. K. Sampathkumar, A. Cebers and J.-F. Berret, Magnetic wire-based sensors for the μ-rheology of complex fluids, *Phys. Rev. E* 2013, **88**, 062306.
[3] J.-F. Berret, Local viscoelasticity of living cells measured by rotational magnetic spectroscopy, *Nature Comm.* 2016, **7**, 10134.