ON THE INTEREST OF PIEZORHEOLOGY TO REVEAL THE MECHANICAL PROPERTIES OF SOFT SOLIDS

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In the design and development of soft solids with functional properties, the knowledge of the mechanical strength is essential. This parameter is generally measured with conventional rheology devices. In some cases, this mechanical strength cannot be measured using such rheometers: when the sample is anisotropic with a mechanical strength depending on the shear direction applied, when the surface of the sample is irregular in shape or when the available amount of product is too small. For such samples, the mechanical properties can be determined with an unusual, home-made shear rheometer, called "piezorheometer". It is a strain applied rheometer, of the plane-plane type, where piezoelectric elements vibrate in translation mode to shear the sample and measured the strain transmitted through it. This device is entirely electrical unlike conventional rheometers. It allows measurements up to very high frequencies (a few kHz), out of reach from conventional rheometer, and requires only small amount of compound for a rheology experience (sample size: thickness < 50 µm and surface <0.5 cm^2). In addition, the measuring cell of this piezorheometer is small enough to be placed in the gap of an electromagnet to carry out experiments with a magnetic field.

To illustrate the possibilities offered by piezorheology, I will present and discuss results obtained in various soft matter systems: polymer gels[1], organogels[2,3], aerogels, compact polyelectrolyte complexes [4,5], and contractile gels based on light-driven molecular motors[6]. Finally, I will conclude this talk by proposing new developments for the piezorheometer device which may provide interesting results in the field of soft matter.

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