

# Rheology of a Gold Meniscus of Few Atoms

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In this talk, we probe plasticity at the individual atomic level by measuring the viscoelastic rheological response of a gold neck of few atoms radius, submitted to picometric oscillations. Shearing the bridge with increasing amplitude, we uncover a dramatic transition from a purely elastic regime to a plastic flow regime, up to the complete shear-induced melting of the bridge. Varying the lateral junction size through a change in conductance, we study the dependence of those distinct rheological regimes on the junction geometry. In those molecular objects, plastic flow seems to be limited by the sliding of atomic planes under shear, as predicted for dislocation free systems, while the dissipative regime is well-described by a viscous-like frictional force, distinct from traditional plasticity models.

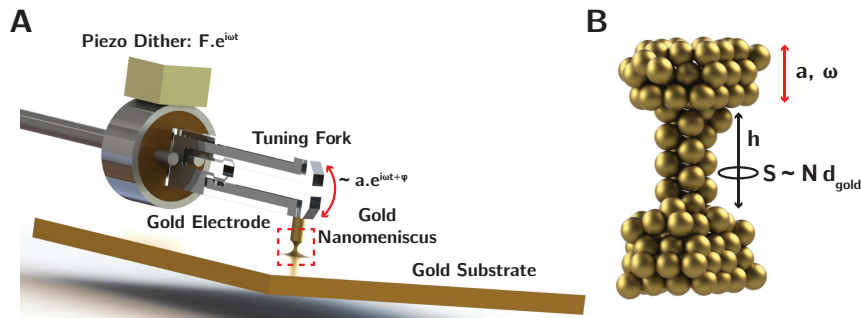


Figure 1: (A) Schematic of the experimental set-up. A gold junction (red dashed box) is formed between a gold electrode, attached to the tuning fork and the gold substrate. A piezo dither excites the tuning fork with an oscillatory force  $F^* = F \cdot e^{i\omega t}$ , leading to an oscillation amplitude  $a^* = a \cdot e^{i\omega t + \phi}$  of the the gold electrode and tuning fork. (B) Schematic representation of the idealized junction geometry, for  $N = G/G_0 \approx 4$ . The junction is assumed to have a rod-like shape with height  $h$  and surface area  $S \sim N d_{\text{gold}}$ .