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Periodic Stresses and Shear Thickening in an Attractive Colloidal Gel[1] CHINEDUM OSUJI, DAVID WEITZ, Applied Physics, Harvard University — We report on the observation of periodic stresses in a colloidal gel at rest and under minute shear deformation. Dilute suspensions of carbon black colloidal particles in hydrocarbon oil with an attractive Van der Waals interaction are found to shear thicken in two distinct regimes. The first, low shear rate regime is ascribed to network elongation and the high shear regime to hydrodynamic clustering, akin to that observed in concentrated hard sphere systems. Due to the attractive interaction between particles, the shear thickened state persists long after cessation of flow and in the high shear rate regime gives rise to high modulus, compacted networks. These gels display residual stresses and exhibit a peculiar time dependent aging in which the normal force exerted by the stationary gel as well as the shear modulus display low frequency long lived oscillations. Simple tensile deformation of the gel results in comparatively higher frequency periodic normal forces. We propose a simple mechanism to account for the observed data.

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