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Rheological & electrical characterization of carbon black suspensions under shear AHMED HELAL, XIN WEI CHEN, FRANK FAN, YET-MING CHIANG, GARETH MCKINLEY, Massachusetts Institute of Technology — Carbon black suspensions are complex fluids that are of interest for applications such as flow batteries, inks, paints & in the oil/gas industry. As the loading concentration of carbon increases, the carbon black forms an electronically-conductive fractal network that gives rise to a gel-like behavior of the suspension beyond percolation. The macroscopic rheological and electrical properties of the suspension depend on the mechanical deformation applied as the microstructure becomes increasingly anisotropic under shear. Using a torsional rheometer with a parallel plate geometry, we characterize the viscoelastic properties of this attractive colloidal dispersion using small amplitude oscillatory shear measurements with increasing concentrations of carbon black. In addition, using a custom-made fixture, we perform measurements of DC & AC conductivity under oscillatory strain sweeps as well as under steady shearing flow and experimentally characterize the decay of conductivity with increasing shear. This characterization of the macroscopic rheological & electrical macroscopic properties will enable experimental verification of continuum models for such materials under shear using concepts such as internal fabric tensors & the evolution of the contact network.

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