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Shear-induced irreversible breakdown of shear thickening fluids JONATHAN SEPPALA, Materials Science and Engineering Division, National Institute of Standards and Technology, Gaithersburg, MD 20899, USA, KIRK RICE, Materials Measurement Science Division, National Institute of Standards and Technology, Gaithersburg, MD 20899, USA, GALE HOLMES, Materials Science and Engineering Division, National Institute of Standards and Technology, Gaithersburg, MD 20899, USA — Amorphous fumed silica/polypropylene glycol (PPG) suspensions were subjected to multiple steady shear and oscillatory shears above the critical strain rate and critical strain amplitude. After each strain sweep, the steady shear viscosity and oscillatory shear moduli decreased over the entire measured range, and the on-set of shear thickening occurred at increasingly higher critical strain rates or strain amplitudes. Analysis of the oscillatory intra-cycle stress-strain (Lissajous-Bowditch) curves indicated a single-cycle shear thickening occurred at strain amplitudes below the traditionally defined critical strain and only during the first pass. The changes in the material properties appear to be irreversible and are attributed to breakdown of fumed silica-PPG agglomerates. Simultaneous rheology and small angle neutron scattering (RheoSANS) was also used to test this hypothesis. Finally intra-cycle and non-linear responses for fumed silica-PPG on parallel plate and cone and plate were analyzed via the MITlaos package.

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