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Non-Newtonian behavior of complex plasma fluids ALEXEI IVLEV, VICTOR STEINBERG, ROMAN KOMPANEETS, GREGOR MORFILL — One of the remarkable aspects of complex plasmas is that although they are intrinsically multiphase systems, the rate of momentum exchange through collisions between the microparticles (grains) can exceed the coupling to the background neutral gas significantly. Therefore complex plasma fluids can act as an essentially single-fluid system. Numerical simulations predict that the shear viscosity of complex plasmas should have strong non-monotonous dependence on the kinetic temperature of grains. We proposed a self-consistent model which allows us to obtain explicit dependence of the viscosity on the velocity shear rate, with well-pronounced shear-thinning and thickening effects. Under certain condition, the stress vs. strain rate dependence becomes N-shaped, suggesting formation of shear bands. We performed a series of experiments in a planar or cylindrical shear flow geometry, similar to the Couette and Poiseuille flows. This allowed us to retrieve the viscosity of complex plasmas, which turned out to be in fairly good agreement with the theory.

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