Abstract Submitted
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Particle alignment under unsteady shear in non-Newtonian fluids causing modulations of effective viscoelasticity[1] TAIKI YOSHIDA, Graduate School of Engineering, Hokkaido University, YUJI TASAKA, YUICHI MURAI, Faculty of Engineering, Hokkaido University — The effective viscoelasticity modulated by particle alignment in unsteady shear in non-Newtonian fluids was revealed by means of ultrasonic spinning rheometry (USR) [Yoshida et al., J. Rheol.(2019)]. The dispersed particles make alignments in the sheared direction in unsteady shear flows when the fluid media have sufficiently long relaxation time. USR evaluated the effective rheological properties modulated by the particle alignments; (1) the effective viscosity does not reach the value estimated by Einstein's law; (2) the effective elasticity increases significantly with the increasing volume fraction of particles in the bulk of the measurement volume. To clarify factors causing the particle alignment in unsteady shear flows/deformations, numerical tests using a simple toy model with considering spring forces connecting between the particles with specific yield stresses were examined. The numerical tests explained the importance of the relaxation process on the orientation of the particles. To conclude the experimental findings supplemented with the results of the numerical tests, we suggest that local and macro rheological characteristics are strongly modulated by the particle alignment when the test fluid media have long relaxation times.

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