Mode Transition of Condensed Colloidal Solutions under Shear Flow

Yukio Yamaguchi, Osamu Koike
Department of Chemical System Engineering, The University of Tokyo.
7-3-1 Hongo, Bunkyo-ku, Tokyo, Japan
yukiyama@chemsys.t.u-tokyo.ac.jp
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The mixing and kneading for condensed colloidal solutions has been attracted a lot of interest over the last few decades. [1] The development of numerical simulation tools to study the complex and variable microstructure of colloidal solutions have contributed to colloid science. [2] Various scientific disciplines have addressed fundamental issues as well as practical problems about the rheology of nanoparticle dispersion. Since the scientific disciplines to understand the problems is still lacking, we have studied the physical and chemical meaning of the mixing and the kneading relating to understanding of shear thinning and thickening.

We show the results of the experiments and the numerical simulation, SNAP (Structure of NAno-Particles), in Figure 1. [3] We have shown the mechanism of the mode transition from shear thinning to shear thickening under shear flow. We also elucidate the meaning of the mixing and the kneading in terms of the shear thinning and thickening of condensed colloidal solutions. The shear thickening transition is shown as one of the non-equilibrium phase transitions.

References

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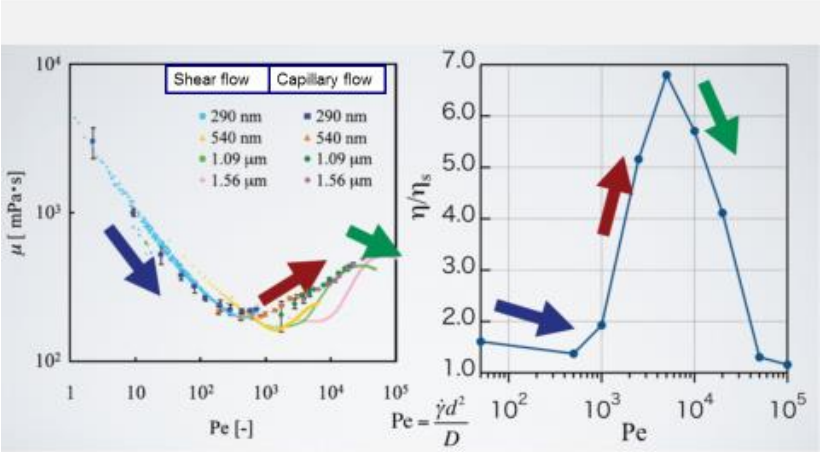

Fig. 1. Shear thinning and thickening of colloidal solutions. Experiments and simulation are shown in the left figure and the right figure, respectively. The volume fraction of silica colloid is 40%. Both of shear flow by cone-and-plate and capillary flow are employed for different size of silica particles.