Electrorheological Fluid Dynamics

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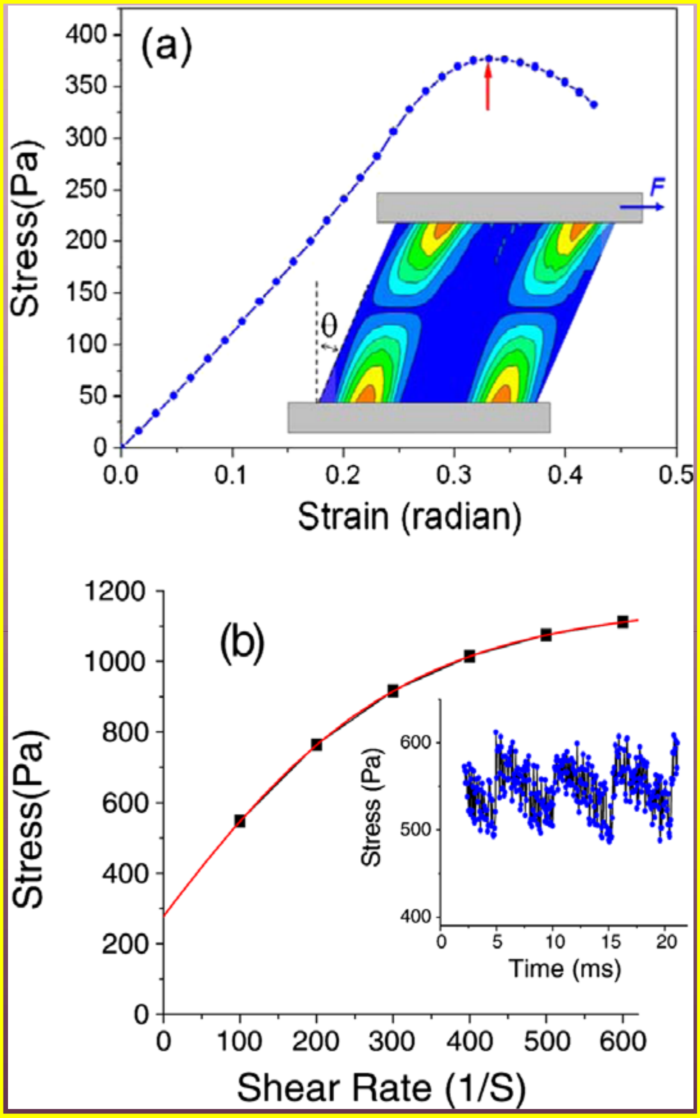

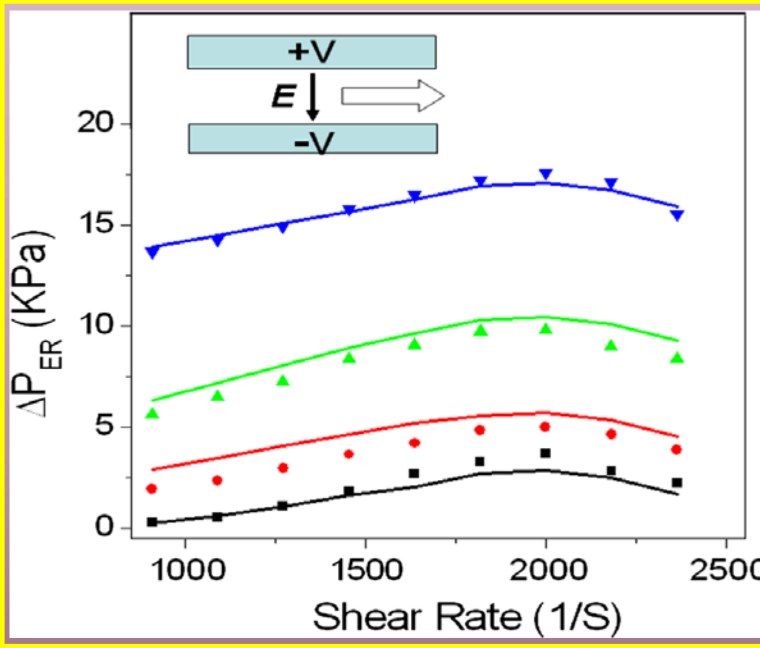

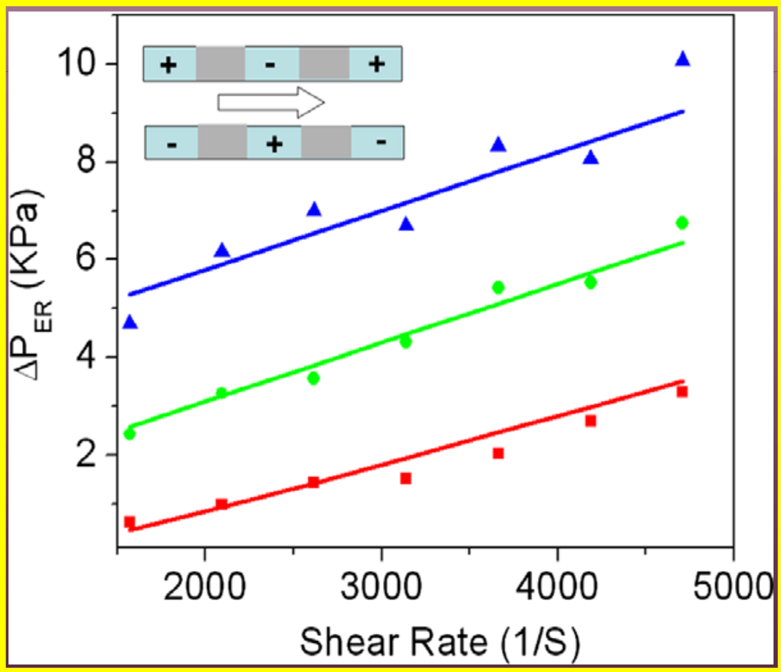

The Onsager principle is employed to derive a two-phase continuum formulation for the hydrodynamics of the electrorheological (ER) fluid, consisting of dielectric microspheres dispersed in an insulating liquid. The predictions of the theory are in excellent agreement with the experiments. In particular, it is shown that whereas the usual configuration of applied electric field being perpendicular to the shearing direction can lead to shear thinning at high shear rates and thus the loss of ER effect, the interdigitated, alternating electrodes configuration can eliminate the shear-thinning effect.