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Physical Origins of Enhanced Interfacial Viscosity in Electroosmotic Flows PENG WU, RUI QIAO, Clemson University — Electroosmotic flows (EOF) is widely used in micro/nanofluidic systems for fluid manipulation. The driving force for EOF exists only within the electrical double layers (EDLs) near charged substrates. While EOFs with thick EDLs are now well-understood, current knowledge on EOFs with EDLs thinner than a few nanometers remains limited. Specifically, experimental evidence suggests that the viscosity of interfacial fluids in EOF is higher than that of bulk fluids, but the physical origins of this universal phenomenon remain elusive. Many mechanisms such as layering of interfacial fluids, high ion concentration in EDL, and polarization of fluids in the EDL have been proposed, but a universal mechanism that encompass the breadth of experimental evidence has not been firmly established. In this work, we use molecular dynamics simulations to compute the effective viscosity of interfacial fluids in carefully controlled EOFs. We examine many mechanisms in the literature and suggest a mechanism that is capable of explaining the enhanced viscosity of interfacial fluids in EOFs regardless of the nature of the solid substrates.

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