Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Study of oscillating electroosmotic flows with high temporal and spatial resolution[1] GUIREN WANG, Northwest University, XIN LIU, University of South Carolina, FANG YANG, Jilin University, KAIGE WANG, JINTAO BAI, Northwest University, RUI QIAO, Virginia Tech, WEI ZHAO, University of South Carolina — In AC electrokinetic (EK) flow where solid-fluid interface exists, oscillating electroosmotic flow (OEOF) is an inevitable flow phenomenon. However, few experimental investigations have been reported on instantaneous velocity of OEOF driven by AC electric field. Here, we studied the near-wall velocity of OEOF by Laser-induced Fluorescence Photobleaching Anemometer (LIFPA). For the first time, an up to 3 kHz velocity response of OEOF had been successfully measured experimentally, even though the oscillating velocity was as low as 600 nm/s. It was found that the oscillating velocity decays with forcing frequency f_f, as $f_f^{-0.66}$. This had never been predicted by any known theoretical investigations. In the investigated range of electric field intensity (E_A), when f_f is below 1 kHz, the linear relation between oscillating velocity and E_A was observed. Besides, we also found the bulk flow velocity can significantly affect the oscillating velocity of OEOF. This was also newly observed and implied the bulk flow can affect the formation process of electric double layer. This investigation could be crucial for understanding all OEOF-related phenomena and designing OEOF-based micro/nanofluidics systems.

[1]The work was supported by NSF (CAREER CBET-0954977, MRI CBET-1040227, CBET-1336004) and NSFC (11672229).

Wei Zhao
Northwest University

Date submitted: 25 Sep 2017 Electronic form version 1.4