Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Non-homogeneous flow profiles in sheared bacterial suspensions
DEVRANJAN SAMANTA[1], XIANG CHENG[2], Univ of Minn - Minneapolis — Bacterial suspensions under shear exhibit interesting rheological behaviors including the remarkable superfluidic state with vanishing viscosity at low shear rates. Theoretical studies have shown that such superfluidic state is linked with non-homogeneous shear flows, which are induced by coupling between nematic order of active fluids and hydrodynamics of shear flows. However, although bulk rheology of bacterial suspensions has been experimentally studied, shear profiles within bacterial suspensions have not been explored so far. Here, we experimentally investigate the flow behaviors of E. coli suspensions under planar oscillatory shear. Using confocal microscopy and PIV, we measure velocity profiles across gap between two shear plates. We find that with increasing shear rates, high-concentration bacterial suspensions exhibit an array of non-homogeneous flow behaviors like yield-stress flows and shear banding. We show that these non-homogeneous flows are due to collective motion of bacterial suspensions. The phase diagram of sheared bacterial suspensions is systematically mapped as functions of shear rates an bacterial concentrations. Our experiments provide new insights into rheology of bacterial suspensions and shed light on shear induced dynamics of active fluids.

[1]Chemical Engineering and Material Science department
[2]Chemical Engineering and Material Science department

Devranjan Samanta
Univ of Minn - Minneapolis

Date submitted: 05 Nov 2015 Electronic form version 1.4