Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Turbulence annihilation in surface tension stratified flow ALFREDO SOLDATI, SOMAYEH AHMADI, ALESSIO ROCCON, FRANCESCO ZONTA, TU Wien, Institute of Fluid Mechanics and Heat Transfer — In this work we use Direct Numerical Simulation (DNS) together with a Phase Field technique to study the turbulent Poiseuille flow of two immiscible liquid layers inside a channel. A thin liquid layer (fluid 1) flows on top of a thick liquid layer (fluid 2), such that their thickness ratio is $h_1 = 9h_2$. The two liquid layers have the same density but different viscosities η. In particular, we consider the case $\eta_2 < \eta_1$. The problem is described by the shear Reynolds number (Re_τ), by the Weber number (We, which quantifies surface tension effects) and by the viscosity ratio λ between the two fluids. Compared to a single phase flow at the same shear Reynolds number ($Re_\tau = 300$), in the two phase flow case we observe an increase of the flow rate of fluid 1 and a strong modification of the turbulence structures near the liquid-liquid interface. Alltogether, these observations support the presence of a significant Drag Reduction (DR), whose efficiency depends strongly on the interface deformability (We) and on the viscosity ratio between the two fluids (λ).

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Date submitted: 31 Jul 2017 Electronic form version 1.4