

Abstract Submitted
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Surface shear viscosity of a lung surfactant: Newtonian to non-Newtonian transition AMIR SADOUGHI, AMIR HIRSA, Rensselaer Polytechnic Institute, JUAN LOPEZ, Arizona State University — DPPC molecule is the most prevalent constituent of lung surfactant, and understanding its behavior as a monolayer may lead to better simulations of respiration. At low surface pressures (i.e. large surface tensions, corresponding to area per molecule of about 50 angstrom squared, or greater), DPPC behaves as a purely viscous film with surface shear viscosity that is Reynolds number independent. Transition to a non-Newtonian regime occurs at large surface pressures. At the small scales associated with the liquid lining of the alveoli, the relative effects of surface viscosities can be comparable to that of surface tension. Here, we examine the interfacial hydrodynamics by isolating the effects of the surface shear viscosity. DPPC monolayer is spread from a concentrated solution at the air/water interface in a deep channel viscometer, consisting of an annular region between two stationary cylinders and a rotating floor. The interfacial velocity is measured non-invasively (without any seeding particles) using Brewster angle microscopy with short laser pulses. The departure from Newtonian behavior is quantified by comparisons to numerical simulations of Navier-Stokes with a Boussinesq–Scriven surface model and various surface shear viscosities.

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