# NEWTONIAN TO NON-NEWTONIAN FLOW TRANSITION IN A LUNG SURFACTANT MODEL (DPPC)


By

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# ABSTRACT

DPPC is studied widely because it is ubiquitous in biological systems, and in particular, because it is the major constituent of natural lung surfactant. Lung surfactants are an essential part of a healthy respiratory system; without these surfactants breathing would be laborious; if not impossible. Quantifying the flow of DPPC (dipalmitoylphosphatidylcholine) films may lead to a better understanding of how the lungs function, and may also lead to improved therapeutics for treating respiratory distress syndrome. DPPC films have been reported to be viscoelastic (non-Newtonian). Here, the surface shear viscosity of DPPC monolayers on the air/water interface was determined over a wide range of surface concentrations in an annular channel. Brewster angle microscopy (BAM) was found to be capable of measuring the monolayer velocity field, even in the absence of coexisting phase domains. Interfacial velocimetry via cross correlations of BAM images provides accurate and non-invasive measurements. Existing methods for microrheology disturb the monolayer microstructure that provide the signal for microrheology. The measured velocity profiles are compared with computed profiles obtained over a range of surface shear conditions using the Boussinesq-Scriven surface model, from which the surface shear viscosity was determined. For monolayers in the liquid expanded (LE) and liquid expanded/liquid condensed (LE/LC) coexisting phases, Newtonian behavior was observed. A departure from the Newtonian regime is also shown corresponding to LC phase transition to solid phase. Experimental methodology was also developed to determine the response of DPPC monolayers to dilatation and compression.