

INTERFACIAL RHEOLOGY OF BIOLOGICAL FLUIDS

G.G. Fuller

Stanford University, Chemical Engineering, Stanford, California, USA

ggf@stanford.edu

Biological fluids are often interfacially active and, consequently, display nonlinear rheological responses at liquid/fluid interfaces. Although much less developed than bulk rheological methods, a number of techniques have been developed to access for the mechanical rheometry of complex interfaces and the corresponding microstructure. This lecture will present results on two systems: the meibomian lipid layer protecting the human eye and biofilms growing at the air/water interface. The latter are of great consequence to infections in the human body and urinary tract infections are an important example.

The work on the meibum will reveal that this phospholipid layer is strongly viscoelastic as a result of strong, long range ordering of the lipids at the air/water interface. It is demonstrated that this viscoelasticity results in a prominent stick/slip phenomena when meibum-covered droplets are forced to advance on solid surfaces. With respect to biofilms, it is demonstrated that interfacial rheology is ideally suited to the detection of the formation of biofilms by colonies of bacteria. This measurement tool is also useful for evaluating the effectiveness of methods of biofilm prevention.