Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Deformation and stability of biomimetic membranes in DC electric pulses PAUL SALIPANTE, PETIA VLAHOVSKA, Brown University — Electrohydrodynamics of vesicles (closed bilayer membranes) made of lipids or polymers are investigated both experimentally and theoretically. When a uniform electric field is applied across a membrane, free charges accumulate on both sides of the membrane and the membrane acts as a capacitor. While the membrane is charging, the vesicle deforms into either an oblate or prolate ellipsoid depending on the bulk fluids conductivities. However, once the membrane is fully charged the vesicle adopts a prolate shape. The evolution of vesicle shape, and in particular the oblate-prolate transition, is experimentally studied for DC pulses of different strength and durations. Membrane composition is varied to observe the effect of membrane viscosity, bending rigidity, and membrane capacitance. The results show that the transient response of the vesicle is sensitive to membrane viscosity, while the steady state shape is mainly controlled by membrane tension. Strong DC pulses, typically used in cell electroporation, induce an instability in both lipid and polymer membranes. The instability leads to vesicle collapse, where the timescale of collapse shows a $t \sim 1/E^2$ dependence.

Petia Vlahovska
Brown University

Date submitted: 30 Jul 2012 Electronic form version 1.4