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Deformation of biomimetic membranes under electroporation using DC electric pulses PAUL SALIPANTE[1], PETIA VLAHOVSKA, Brown University — Electrohydrodynamics of vesicles (closed bilayer membranes) made of lipids or polymers are investigated under strong DC pulses. 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. In strong DC pulses, typically used in cell electroporation, the electric stress can induce pores in both lipid and polymer membranes. The instability short-circuits the membrane capacitor, leading to non-ellipsoidal shape and vesicle collapse. The evolution of vesicle shape and the effect of poration is experimentally studied for DC pulses of different strength and duration. Vesicle shape is related to the critical threshold for membrane poration. Membrane composition is varied to observe the effect of membrane viscosity, membrane capacitance, and poration threshold. The transient response of the vesicle, in particular vesicle collapse, is shown to be sensitive to membrane viscosity.

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