Abstract Submitted
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Influence of membrane viscosity on dynamics of capsules and red blood cells[1] ALIREZA YAZDANI, PROSENJIT BAGCHI, Rutgers, The State University of New Jersey — Most previous continuum-level numerical studies on capsule and erythrocyte dynamics have ignored the role of membrane viscosity. We present a numerical method using a Kelvin–Voigt viscoelastic model for the capsule membrane. We observe that the membrane viscosity leads to buckling in the range of shear rate in which no buckling is observed for capsules with purely elastic membrane. For moderate to large shear rates, the wrinkles on the capsule surface appear in the same range of the membrane viscosity that was reported earlier for artificial capsules and red blood cells based on experimental measurements. It is also observed that the bending stiffness required to obtain stable shapes is also in the same range as that reported for the red blood cells, but considerably higher than that estimated for artificial capsules. Membrane viscosity is observed to reduce cell deformation, and introduce a damped oscillation in time-dependent deformation and inclination. The time-averaged inclination angle and the tank-treading frequency show nonmonotonic trends with increasing membrane viscosity. Further, the dynamics of a non-spherical capsule is observed to change from a swinging motion to a tumbling motion with increasing membrane viscosity.

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