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Swinging of two-domains vesicles in shear flow ANNIE VIALLAT, CNRS, SIMON TUSCH, KAMEL KHELLOUFI, Aix Marseille University, MARC LEONETTI, CNRS — Giant lipid vesicles and red blood cells in shear flow at low shear rates tank tread (TT) at small viscosity ratio between the inner particle volume and the external fluid, and flip or tumble (T) at large viscosity ratio. The phase diagram of motion of red blood cells is however much more complex. Swinging superimposes to TT, cells wobble and roll rather than tumble with increasing shear rate and present a shear-rate driven transition between TT to T. These features are attributed to the shear elasticity and the non spherical stress-free shape of the cell membrane, which stores shear elastic energy as a function of the relative position of its elements. We have created vesicles with a phase diagram of motion comparable to that of red blood cells by preparing membranes with two lipids and cholesterol. These membranes present two domains separated by a contact line. The line has a tension energy that depends on its relative position on the vesicle. Similarly to red blood cells, two-domains vesicles swing and wobble. An analytical model where line tension energy is added to the Keller and Skalak's model fits our experimental data without any adjustable parameter. Our experiments and model shed light on the motion of deformable particles in shear flow.

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