360h Measurement of Electrophoretic Mobility of Ionic Surfactant

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We consider a spherical-dielectric drop with ionic surfactant on the drop surface in another dielectric fluid medium in the Stoke flow regime. The drop is subject to an uniform electric field, which transports the drop by electrophoresis. The ionic surfactant molecules are also moved along the surface not only by the fluid flow but also by the applied electric field, accompanying concentration gradient which again results in surface tension gradient. To compensate for this surface tension gradient, there occurs fluid flow so called the Marangoni flow. This Marangoni flow can either retard or expedite the translation of a drop depending on the surfactant concentration distribution. By investigating the equilibrium surfactant concentration distribution, the resulting flow field, and the electrophoretic terminal velocity of a drop numerically, we got the basic design information about the drop based MEMS device which uses a drop as a transporting tool. We can estimate the terminal velocity of a drop in the Stoke flow regime for the fixed surfactant case because the electrostatic force is proportional to the total amount of surface charge. But when the surfactant molecules move along the drop surface the terminal velocity can be either larger or smaller than the fixed surfactant case depending on the surfactant concentration distribution. By examining the electrophoretic terminal velocity with changing the electrophoretic mobility of surfactant molecule numerically, we contrived a method for measuring the electrophoretic mobility of ionic surfactant molecule. We also expect that the present method can be used for measuring many kinds of charged particle's mobility.