World Academy of Science, Engineering and Technology
International Journal of Physical and Mathematical Sciences
Vol:12, No:06, 2018

Deformation of Particle-Laden Droplet in Viscous Liquid under DC Electric Fields

Authors : Khobaib Khobaib, Alexander Mikkelsen, Zbigniew Rozynek

Abstract : Electric fields have proven useful for inducing droplet deformation and to structure particles adsorbed at droplet interfaces. In this experimental research, direct current electric fields were applied to deform particle-covered droplets made out of silicone oil and immersed in castor oil. The viscosity of the drop and surrounding fluid were changed by external heating. We designed an experimental system in such a way that electric field-induced electrohydrodynamic (EHD) flows were asymmetric and only present on one side of the drop, i.e., the droplet adjoined a washer and adhered to one of the electrodes constituting the sample cell. The study investigated the influence of viscosity on the steady-state deformation magnitude of particle-laden droplets, droplet compression, and relaxation, as well as particle arrangements at drop interfaces. Initially, before the application of an electric field, we changed the viscosity of the fluids by heating the sample cell at different temperatures. The viscosity of the fluids was varied by changing the temperature of the fluids from 25 to 50°C. Under the application of a uniform electric field of strength 290 Vmm^{-1}, electric stress was induced at the drop interface, yielding drop deformation. In our study, we found that by lowering the fluid viscosity, the velocity of the EHD flows was increased, which also increases the deformation of the drop.

Keywords : drop deformation and relaxation, electric field, electrohydrodynamic flow, particle assembly, viscosity
Conference Title : ICAMSMBP 2018 : International Conference on Atomic, Molecular, Soft Matter and Biological Physics
Conference Location : Vienna, Austria
Conference Dates : June 14-15, 2018