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Faradaic Reaction Mechanisms in Leaky Dielectric Liquids (Oils)¹ ABHILASH SANKARAN, CHRISTOPHER STASZEL, FARZAD MASHAYEK, ALEXANDER YARIN, University of Illinois at Chicago — Leaky dielectric liquids constitute a class of conductors capable of being electrified to possess a net charge. Faradaic reactions have been recently demonstrated to be responsible for the electrification of such liquids as oils in electrostatic atomizers. Here we address questions related to fundamental chemical kinetics and physical mechanisms and experimentally demonstrate the applicability of the Frumkin-Butler-Volmer kinetic model. We also introduce a novel method of measurement of the electric conductivity of oils. The role of the fatty acids in faradaic reactions is studied, as well the effect of the surrounding humidity on the physico-chemical mechanisms responsible for the ionic conductivity of oils. Cathodic and anodic reactions are discussed in detail, as well as the visible deposits formed at electrode surfaces.

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