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Critical frequency for coalescence of emulsions in an AC electric field. ZHOU LIU, Shenzhen University, FAIZI HAMMAD ALI, Brown University, HO CHEUNG SHUM, University of Hong Kong — Applying an electric field to trigger the coalescence of emulsions has been applied in various applications which include crude oil recovery, emulsion stability characterization as well as pico-injection and droplet-based chemical reaction in microfluidics. In this work, we systematically investigated the responses of surfactant-stabilized emulsions to a controlled AC electric field using a customer-built chip. At a given amplitude of the AC voltage, we found a critical frequency beyond which the emulsions remain stable. When the frequency is decreased to below the critical value, emulsions coalesce immediately. Such critical frequency is found to be dependent of amplitude of the AC voltage, viscosity of the fluids, concentration and type of the surfactant as well as the electric conductivity of the droplet phase. Using a model based on the drainage of thin film, we have explored the mechanism behind and interpret this phenomenon systematically. Our work extends the understanding of the electro-coalescence of emulsions and can be beneficial for any applications involve the coalescence of droplets in an AC electric field.

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