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Destruction of Emulsions by an AC Electric Field: Importance of Partial Merging[1] ABDOU RACHID THIAM, NICOLAS BREMOND, JERÔME BIBETTE, LCMD-ESPCI-PECSA-CNRS — Electrocoalescence is basically the process of blending droplets by the application of an electric field. The approach is used in petroleum refineries for the separation of water in oil emulsions (that is, by coalescing water droplets), and more recently in biotechnology industry, for the fusion of micro reactors. In a first step, we will focus on the coalesce condition for two drops under a given electric field. Microfluidics offers a comfortable setup therefore, as we sought to span a range of initial conditions in terms of the distance between the droplets, their sizes, and also a region of the applied electric field. Thus, we could establish a stability diagram according to the initial conditions and droplets' composition, which displays three domains referred to as: coalescence, no coalescence and a third one of partial coalescence, where the droplets coalesce for a brief moment then separate right afterwards. We proceeded then by generalizing the setup to the case of a stream of droplets, and we found that the evolution of the stream can be predicted by the behaviour of the local pairs of droplets, as seen in the previous step. The main outcome of that study is the total destruction of an emulsion above a critical volume fraction for a given amplitude of electric field.

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