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Plasma Discharge Development in Dissimilar Multi-liquid Configuration ALI CHARCHI AGHDAM, TANVIR FAROUK, University of South Carolina — Plasma discharges in liquids is an emerging field of research and is involved into a wide range of applications – water purification, fuel reforming, material synthesis etc. Having a high treatment efficiency with low energy consumption is one of the main objectives driving the research agenda. In this work we present a numerical study of nanosecond plasma discharge formation in a multi-liquid system where the dielectric permittivity of the two liquids are significantly different. The simulations are conducted with a recently developed multiphysics model comprising of species conservation equations, Poisson's equation for the electric field and a compressible momentum equation solver. Special attention has been given to the numerical approximation of the electrical forces since they are highly dependent on the fluid property gradients which are difficult to evaluate at the interface discontinuity. Predictions from the model provide insight on the role of interface position relative to the anode tip on the discharge initiation process. It is observed that since the dielectric permittivity is discontinuous at the interface, the electric field is enhanced by a factor that depends on the relative value of the dielectric permittivity of the two liquids.

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