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A volume of fluid (VOF) based approach for modeling plasma discharge in multi-fluid configuration ALI CHARCHI AGHDAM, TANVIR FAROUK , Department of Mechanical Engineering, University of South Carolina — Despite the large volume of experimental studies on plasma discharges in multi-fluid/multi-liquid configuration there is still no notable modeling effort in simulating the multi-physics problem. In this work, a multi-physics numerical framework is developed to study the plasma discharge in a two-liquid system. The multi-physics model consists of Poisson's equation solver, species solver and, multi-phase fluid flow solver. A Volume of Fluid (VOF) based approach is used to resolve the two-phase flow problem. Properties of liquids and plasma species are updated based on the electric field and phase composition. The evolution of interface as well as plasma discharge pattern is studied as a function of initial interface location, voltage profile, and permittivity ratio of the phases. The VOF method was successful in capturing the evolution of the fluid interface due the presence of the electric field and associated plasma charges. The results show that the discharge profile has a strong dependence on the interface location. Also, it is found that the two-phase configuration has an enhancing effect on the electric field and plasma discharge can be achieved at lower voltages thus proving to be an energy efficient method for practical applications.

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