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Multiphysics Modeling of Plasma Discharge in Liquids: Simulation of Plasma Initiation Under Linear Ramp and Nanosecond Pulse Condition ALI CHARCHI AGHDAM, TANVIR FAROUK, University of South Carolina — In this work, a mathematical model has been developed to simulate the initiation and propagation of plasma in a liquid medium. The model consists of a density based compressible momentum solver coupled with electric forces acting on the liquid. Electrostatic, polarization and electrostriction forces are considered. The Poisson's equation is solved to obtain the electric field distribution. Species conservation equations together with the associated plasma reaction kinetics are solved to resolve the spatial and temporal evolution of the charged species in the liquid medium. Simulations are conducted both for a linear ramp and nanosecond pulse of the driving voltage. The results show that the ponderomotive forces are dominant in the all of the cases studied. The polarization force becomes relevant at later times when a gradient in electric permittivity is developed. The negative pressure generated by the electric field is found to be below the critical value for water (˜30Mpa). Comparison between the linear ramp and nanosecond pulse further shows that under the nanosecond pulse condition a compression wave accompanies the expansion wave in the system.

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