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Simulation of 1D Dielectric Barrier Discharge in Argon Mixtures

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Abstract : This work aims at modeling electric discharges in gas mixtures. The mathematical model mimics the ignition process in a commercial spark-plug when a high voltage is applied to the plug terminals. A longitudinal unidimensional Cartesian domain is chosen for the simulation region. Energy and mass transfer are considered for a macroscopic fluid representation, while energy transfer in molecular collisions and chemical reactions are contemplated at microscopic level. The macroscopic model is represented by a set of uncoupled partial differential equations. Microscopic effects are studied within a discrete model for electronic and molecular collisions in the frame of ZDPlasKin, a plasma modeling numerical tool. The BOLSIG+ solver is employed in solving the electronic Boltzmann equation. An operator splitting technique is used to separate microscopic and macroscopic models. The simulation gas is a mixture of atomic Argon neutral, excited and ionized. Spatial and temporal evolution of such species and temperature are presented and discussed.

Keywords : CFD, electronic discharge, ignition, spark plug
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