One-dimensional Modeling of Plasma-electrode Pockels Cell Driven by One-pulse Process

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Plasma-Electrode Pockels Cells (PEPC) are used as large-aperture optical switch in laser drivers for inertial-confinement fusion. Plasma electrodes are produced by high discharge current, while a high voltage pulse is applied across a thin KDP crystal plate through plasma, which is produced by discharge in the gas-filled cells. Gaseous ionization rises over the entire transverse section of the cells, and forms highly conductive and transparent plasma charge sheaths on the surfaces of the KDP crystal plate. In the working of PEPC in one pulse process without prior ionization of gas, the discharge plasma evolution process is time dependent. In this paper, we will present a one-dimensional modeling of processes of gaseous discharge and charging on the surfaces of KDP crystal in PEPC. Our modal is based on a simplified set of fluid equations, which is electron motion and ion motion governed by the equations of continuity and momentum conservation. The electric field distribution in the discharge cell is obtained by Poisson equation. This modeling gives the time-dependent discharge current and charging characteristics on the KDP crystal.