MODELING AND EXPERIMENT DESIGN FOR DETERMINING ELECTRIC FIELD IN PULSED-NANOSECOND DISCHARGES*

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The use of pulsed-nanosecond discharges at near atmospheric pressures is of interest for a number of reasons. The use of arc ignition in combustion engines has persisted since their invention, but this type of discharge offers potential for improving combustion characteristics[1]. Additionally, such plasmas could provide a means for the conversion of methane into higher, more attractive, hydrocarbons[2]. Here, the model of Adamovich et al.[3] is modified to match the discharge conditions of the nanosecond-discharge facility in Vacuum Facility 69 at NASA Glenn Research Center[4]. The model produces time and space dependent values for the electric field, electron density, and sheath boundary. Predictions of energy absorption and coupling efficiency also result from this analysis. An experiment utilizing coherent anti-Stokes Raman scattering spectroscopy is proposed for determining the electric field. The experiment is based on previous research conducted by Evsin et al.[5] Success of the experiment would provide critical validation of analytic and numerical models for pulsed-nanosecond discharges. Such measurements are necessary precursors to further research into pulsed, nonthermal plasmas which have applications in supersonic and hypersonic transport[4].

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