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Self-Pulsing Non-Equilibrium Plasma Discharge at Atmospheric and Higher Pressures RAJIB MAHAMUD, Graduate Research Assistant, Department of Mechanical Engineering, University of South Carolina, TANVIR I. FAROUK, Assistant Professor, Department of Mechanical Engineering, University of South Carolina — Recently there has been research trust directed towards the development of high pressure non-thermal plasma with a focus to overcome the limitations of their low pressure counter parts. Among the different high pressure non-thermal discharges *micro plasma* continues to be a topic of immense interest. Even though micron sized inter-electrode separation has been successful in attaining non-thermal plasma conditions at atmospheric pressure, the small size cause the effect of other operating parameters to be crucial in stable operation. In this study, simulation of DC micro plasma discharge has been conducted using a hybrid model with detailed helium-nitrogen feed gas kinetics. Simulations were conducted over a broad range of pressure 1 – 10 atm, and power circuit parameters. The self-pulsing regime was found to operate in the subnormal regime and is triggered when the circuit response time starts becoming comparable and larger than the ion transit time. The simulations further indicated that the oscillation frequency increases as the discharge current increases in the subnormal regime. In this self-pulsing regime of operation insignificant increase in the gas temperature is observed confirming that the self-pulsing is not due thermal instability. Results from the study showed that this self-pulsing mode is more prevalent at higher pressure. The oscillation frequency increased almost in a linear fashion as a function of pressure. Predictions were found to be good agreement with experimental measurements.

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