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Striations in DC Driven Discharges in Nitrogen MALIK TAHIYAT, TANVIR FAROUK, SHAMIA HOQUE, University of South Carolina — A striated positive column was observed when low pressure dc discharge experiments were performed in nitrogen operating at 0.7 Torr with an inter-electrode spacing of 15.5 cm. Visualization of the discharge showed that as discharge current was raised from 0.5 to 14.8 mA, number of striations decreased and thickness of negative glow region increased. 1-D simulations of the experiments were conducted employing a fluid model with detailed nitrogen kinetics, incorporating multiple levels of vibrational and electronic excitations. Predictions from the model were found to qualitatively agree with experimental observations of the striated positive column and the dependence of the number of striations on discharge current. Perturbation analysis of chemical kinetics identified the vibrational excitation reactions to be the most sensitive to the striation behavior. Sensitivity analysis further indicated that as vibrational cross sections were increased and decreased, magnitude of intensity of each striated segment intensified and subsided respectively. A detailed analysis of the kinetics reveals that the onset of striations results from the delayed initiation of the ionization reaction due to the predominance of vibrational reactions at lower electron temperatures and vice versa.

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