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Characterization of high-pressure carbon dioxide glow discharge approaching supercritical conditions. GREGORY BELK, ISAAC YAGHI, TANVIR FAROUK, University of South Carolina — A plasma reactor capable of operating at supercritical conditions has been designed and fabricated. The reactor allows for the initiation of plasma discharges in different feed gases at their respective supercritical conditions to conduct the necessary diagnostics. As a test case, experiments were conducted with carbon dioxide as the feed gas for a dc power driven plasma discharge. Despite the extensive studies done on glow discharges in a variety of conditions, literature centered around characterizations of these plasmas in high-pressure environments, and more specifically for supercritical conditions, is lacking. This study aims to experimentally observe dc driven glow discharges between a pointed anode and flat cathode in carbon dioxide and to conduct the necessary characterization. Voltage-Current characteristics, current density measurements and visualizations of the discharges relative to the VI distributions were gathered for pressures beginning at 1 atm and increased up to 75 atm within the test cell. Emission spectroscopy was used to determine localized species and measure spatially averaged gas temperatures between the electrodes. We envision that the data gathered could prove vital for validation of plasma kinetics associated with gaseous carbon dioxide.

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