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Experimental Investigation of Pulsed Nanosecond Streamer Discharges for CO_2 Reforming MICHAEL PACHUILO, DIMA LEVKO, LAXMINARAYAN RAJA, PHILIP VARGHESE, The University of Texas at Austin —
Rapid global industrialization has led to an increase in atmospheric greenhouse gases, specifically carbon dioxide levels. Plasmas present a great potential for efficient reforming of greenhouse gases. There are several plasma discharges which have been reported for reforming process: dielectric barrier discharges (DBD), microwave discharges, and glide-arcs. Microwave discharges have CO_2 conversion energy efficiency of up to 40% at atmospheric conditions, while glide-arcs have 43% and DBD 2-10%. In our study, we analyze a single nanosecond pulsed cathode directed streamer discharge in CO_2 at atmospheric pressure and temperature. We have conducted time resolved imaging with spectral bandpass filters of a streamer discharge with an applied negative polarity pulse. The image sequences have been correlated to the applied voltage and current pulses. From the spectral filters we can determine where spatially and temporally excited species are formed. In this talk we report on spectroscopic studies of the discharge and estimate plasma properties such as temperature and density of excited species and electrons. Furthermore, we report on the effects of pulse polarity as well as anodic streamer discharges on the CO_2 conversion efficiency. Finally, we will focus on the effects of vibrational excitation on carbon dioxide reforming efficiency for streamer discharges. Our experimental results will be compared with an accompanying plasma computational model studies.

Michael Pachuilo
University of Texas at Austin

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