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2P81 - Impact on electrodes during plasma decomposition of carbon dioxide

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A reactor being developed and instrumented for plasma decomposition of carbon dioxide contains a pin-to-plane microdischarge, with a stainless steel pin and aluminum electrode. The degradation of the aluminum electrode over testing time is an unwanted effect of this particular system. A predictive model of degradation of the current electrode is being developed to relate the system parameters and treatment time with degradation of the electrode. Other aspects of the set-up are also being studied based on this phenomenon, including energy losses from the system, which can detract from the overall efficiency of the process of plasma decomposition of carbon dioxide. A test electrode of aluminum is arranged with a demarcated grid of test sections. Then, plasma discharges are applied at the centers of these grids within each area of approximately 2 mm x 2mm. Scans of these areas are taken using a three-dimensional optical profiler for non-contact measurement and characterization of micro- and nano-scale features of the aluminum surface. It should be noted that the instrumentation utilized provides up to 0.15 nm vertical precision. Hence, a predictive model can be developed with the purpose of determining how long the discharge gap length can remain within a reasonable range to sustain the plasma discharge across the electrodes. Toward the goal of engineering a plasma system which can be consistently deployed to decompose carbon dioxide, considerations on longevity of the electrodes and/or necessary maintenance can be a useful step in scaling these systems and preparing them for more widespread use. Results will include impact of the microdischarge on the electrodes during typical treatment times of plasma decomposition of carbon dioxide.

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