

Abstract Submitted
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Thrust Measurement of Dielectric Barrier Discharge (DBD) Plasma Actuators¹ DAVID E. ASHPIS, NASA Glenn Research Center, MATTHEW C. LAUN, Sierra Lobo Inc. — DBD plasma actuators generate a wall-jet that can be used for active flow control. We used an analytical balance to measure the thrust generated by the actuator, it is a common metric of its performance without external flow. We found that the measured force is afflicted by several problems; it drifts in time, not always repeatable, is unstable, and depends on the manner the voltage is applied. We report results of investigations of these issues. Tests were conducted on an actuator constructed of 1/4 inch thick high-density polyethylene (HDPE) dielectric with 100 mm long offset electrodes, with applied voltages up to 48 kV p-p and frequencies from 32 Hz to 2.5 kHz, and pure Sine and Trapezoidal waveforms. The relative humidity was in the range of 51-55%, corresponding to moisture range of 10,500 to 13,000 ppm mass. Force readings were up to 500 mg, (approximately 50 mN/m). We found that the measured force is the net of the positive thrust generated by the wall-jet and an “anti-thrust” acting in the opposite direction. We propose a correction procedure that yields the plasma-generated thrust. The correction is based on voltage-dependent anti-thrust measured in the low frequency range of 20-40 Hz. We found that adjacent objects in a test setup affect the measured thrust, and verified it by comparing experiments with and without a metal enclosure, grounded and ungrounded. Uncorrected thrust varied by up to approximately $\pm 100\%$, and the corrected thrust variations were up to approximately 30%.

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