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Experimental study of plasma induced flow actuation by direct current discharge. JICHUL SHIN, NOEL CLEMENS, LAXMINARAYAN RAJA, The University of Texas at Austin — Plasma induced flow actuation using direct-current discharge is conducted at high pressure. The actuator is made of ceramic dielectric plate on which pin-like electrodes (dia. 1/16 inches) are flush mounted. The experiment is conducted in stagnant air at 1 atm.. The velocity field of induced flow is acquired at 10 Hz rep. rate using PIV technique with TiO_2 seeding. Under low current DC discharge conditions ($\sim$ 10's mA), a flow is induced by electrohydrodynamic (EHD) forces in the direction from the anode to the cathode. The induced velocity with a continuous 26 mA DC is about 1 m/s with one pair of electrode being turned on. When the DC is pulsed, the flow actuation is improved for pulse frequencies upto about 1 kHz and diminishes for higher frequencies. Also the average discharge power is reduced with pulsed DC. The decrease of pulse duration also improves the actuation down to 50% duty cycle but lower duty cycles reduces the actuation. For larger area actuation such as in airfoils, a linear array of discharges is required to produce an actuation over a finite span-wise length. With an array of discharges, it is expected to reduce the viscous effect of individual actuator pair and hence to improve the actuation performance. The effect of an array of discharges will be presented at various conditions. The performance will be compared with dielectric-barrier discharge (DBD) actuator.

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