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Characterization of supersonic flow boundary layer in the presence
of a DC Glow Plasma Discharge Actuator VENKAT NARAYANASWAMY, JICHUL SHIN, LAXMINARAYAN RAJA, NOEL CLEMENS, University of Texas at Austin — An experimental investigation is performed to study the effect of DC surface glow discharge on a Mach 3 supersonic boundary layer. A flat plate with pin-like electrodes (∼0.1" dia) flush mounted on the surface is used. Boundary layers ranging from laminar to turbulent are studied. The DC surface glow discharge provides a high bandwidth flow actuation with characteristic actuation time scale smaller than 0.1 milliseconds and with actuator power of just a few 10's of Watts. Laser schlieren imaging reveals immediate formation of a weak shock in the presence of the discharge. Previous work indicates the bulk heating and also perhaps electrostatic forcing as the primary sources of flow actuation. The average gas temperature at the set point current, estimated using optical emission spectroscopy is around 500 K, which is about 5 times the free stream temperature. The discharge is found to be about 3 mm high, which is approximately the boundary layer thickness. Planar laser scattering from a condensed fog is used to visualize the effect of the discharge on the flow.

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