IMPROVED SCHLIEREN IMAGING OF INDUCED AIRFLOW TOPOLOGIES PRODUCED BY DIELECTRIC BARRIER PLASMA ACTUATORS

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Schlieren imaging methods measure the first derivative of density in the direction of a knife-edge spatial filter. It has been used extensively in aerodynamic research to visualize the structure of flow fields. Here we investigate single barrier planar dielectric barrier discharge (DBD) actuators. The heating associated with the plasma discharge is not adequate to provide good Schlieren imaging. This problem was resolved by addition of spatially adjustable heat sources. Buoyancy plumes rising from resistively heated spanwise tungsten wires along with the Schlieren technique were used to study the induced flow topology. The experiment was carried out using several actuator electrode diameters/widths, applied high voltages and frequencies. Correlation between the electrode dimensions, size and shape of induced swirls above the exposed electrode and induced body force are identified. Time-resolved Schlieren imaging of pulsating buoyant plumes passing through the plasma field was used to measure the instantaneous velocity of various flow fields.

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