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Flow-field characterization of DBD plasma actuators as discrete roughness elements for laminar flow control[1] S.A. CRAIG, R.A. HUMBLE, J.W. HOFFERTH, W.S. SARIC, Texas A&M University — For many years there has been an evolving interest in controlling boundary layer transition on swept-wings. With an appropriate distribution of spanwise-periodic discrete roughness elements (DRE), subcritical wavelengths can be excited which supersede the growth of the most-amplified wavelength, thereby delaying the crossflow-dominated laminar-turbulent transition. To elucidate the physics of annular DBD plasma actuators for potential use as DRE and facilitate effective design, they are studied under quiescent flow conditions using particle image velocimetry a photomultiplier tube (PMT) and a high-speed camera. A complex flow-field is generated by a single aperture that describes a three-dimensional torus accompanied by a downward, wall-normal jet region. The flow-field is sensitive to aperture size and applied voltage. For arrayed actuators, the tori contract dramatically due to the interaction with vortices from adjacent apertures. A PMT in conjunction with a high-speed camera were used to observe the light intensity from the bulk plasma at high temporal resolution and visualize the individual discharge events.

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