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Turbulent Mixing Layer Control using Ns-DBD Plasma Actuators[1] ASHISH SINGH, JESSE LITTLE, University of Arizona — A low speed turbulent mixing layer (Re_{θ_o}=1282, $U_1/U_2 = 0.28$ and $U_2 = 11.8m/s$) is subject to nanosecond pulse driven dielectric barrier discharge (ns-DBD) plasma actuation. The forcing frequency corresponds to a Strouhal number (St) of 0.032 which is the most amplified frequency based on stability theory. Flow response is studied as a function of the pulse energy, the energy input time scale (carrier frequency) and the duration of actuation (duty cycle). It is found that successful actuation requires a combination of forcing parameters. An evaluation of the forcing efficacy is achieved by examining different flow quantities such as momentum thickness, vorticity and velocity fluctuations. In accordance with past work, a dependence is found between the initial shear layer thickness and the energy coupled to the flow. More complex relationships are also revealed such as a limitation on the maximum pulse energy which yields control. Also, the pulse energy and the carrier frequency (inverse of period between successive pulses) are interdependent whereby an optimum exists between them and extreme values of either parameter is inconsonant with the control desired. These observations establish a rich and complex process behind ns-DBD plasma actuation.

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