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Supersonic Flow Control by a Nanosecond Pulse Surface Dielectric Barrier Discharge IGOR ADAMOVICH, MUNETAKE NISHIHARA, KEISUKE TAKASHIMA, J. WILLIAM RICH, The Ohio State University — Results of experiments demonstrating Mach 5 bow shock control by a nanosecond pulse surface dielectric barrier discharge are presented. The experiments are conducted in a blowdown Mach 5 wind tunnel. A steady-state bow shock is generated ahead of the cylinder model. A surface DBD discharge powered by repetitive nanosecond pulses (peak voltage 30 kV, pulse duration 5 nsec, pulse repetition rate up to 100 kHz) is sustained on the model. Phase-locked schlieren images show that several microseconds after the nanosecond discharge pulse, an additional shock wave is generated upstream of the baseline shock. At longer delay times, the shock wave generated by the discharge pulse moves to the periphery of the baseline bow shock, until the two shocks merge. This suggests that the use of a higher pulse repetition rate, of the order of 100 kHz, would result in a quasi-steady state change of the bow shock shape, rather than a periodic change observed at the present conditions. The fundamental difference of the present approach from supersonic flow control using high-power lasers, plasma torches, and arc discharges is that the flow field is modified due to rapid localized energy coupling (on the time scale of 10 nsec) in a low average power plasma actuator placed on the surface of a model in the supersonic flow.

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