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Transient flow control effect of Quasi-DC filamentary plasma in Mach 2 and Mach 4 supersonic flows[1] YASUMASA WATANABE, University of Notre Dame, The University of Tokyo, SKYE ELLIOTT, ALEC HOUPT, SERGEY LEONOV, University of Notre Dame — This study explores the effect of pulse-periodic quasi-DC filamentary plasma on the flow structure over 15-degree compression ramp in Mach 2 and Mach 4 airflows. A major attention is focused on transient phenomena related to plasma-flow interaction. Experiments were conducted in supersonic wind tunnel SBR-50 at the University of Notre Dame. Pulse-periodic plasma generator, operating at the frequency ranging from 250 to 5000 Hz, was installed flush-mounted crossflow in front of the compression ramp. Flow stagnation pressure and temperature were varied as 1-4 bar and 300-600K respectively. The transient flow structure and plasma filament behavior were visualized with schlieren method and high speed camera. The surface pressure distribution on the wall surface and at the ramp was measured with fast pressure transducers. The plasma generated upstream of the compression ramp shifts the shock position from the ramp to the electrode location, subsequently forming a separation zone and resulting in pressure change behind electrodes and over the ramp surface both in cases of Mach 2 and Mach 4 flows. Pressure change was characterized as a function of flow/plasma parameters.

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