

Prediction of Aerodynamic Heating over the Protuberance in Hypersonic Flow

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An Experimental study was conducted on the flow characteristics and interference heating caused by a two-dimensional protuberance protruding from a flat plate using a hypersonic wind tunnel of University of Tokyo. Inflow condition was a free-stream Mach number of 7.0 and a unit Reynolds number of $2.0 \times 10^6/m$. Experimental conditions were varied with three heights of protuberance (6, 12, 18 mm) for two flat plate models which have different length (165, 320 mm). Experimental data were obtained from Schlieren visualization images and heat flux measurement using heat flux gauges. Large separation region was observed in front of the protuberance and that region was very sensitive with the height of protuberance and the length of flat plate. For only the highest protuberance (18 mm), a severe jump of heat flux was observed at the top station among the measuring points. Measured heat flux is larger as the height of protuberance is large and the length of flat plate is long.

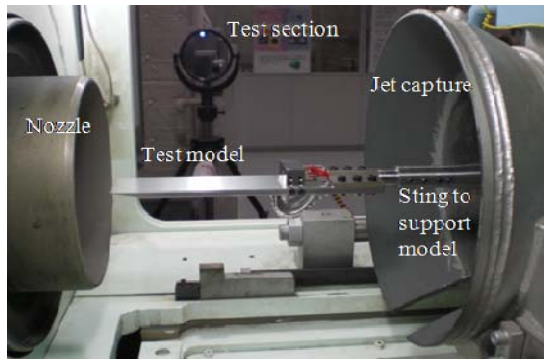


Fig. 1 Test Model installed Test Section

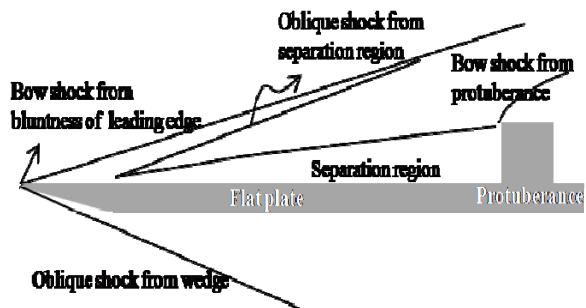


Fig. 2 Schematic of flow characteristics

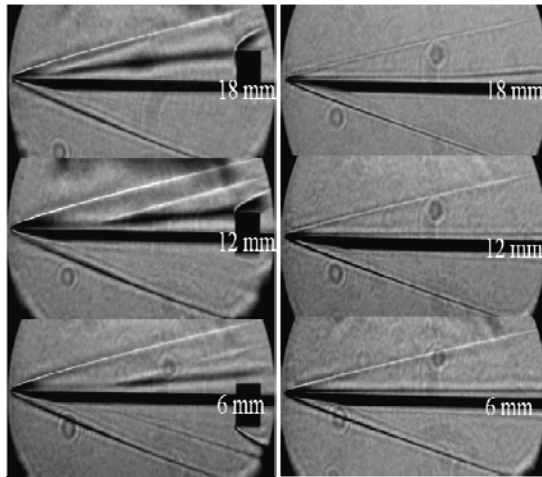


Fig. 3 Schlieren images(Left:short model Right:long model)

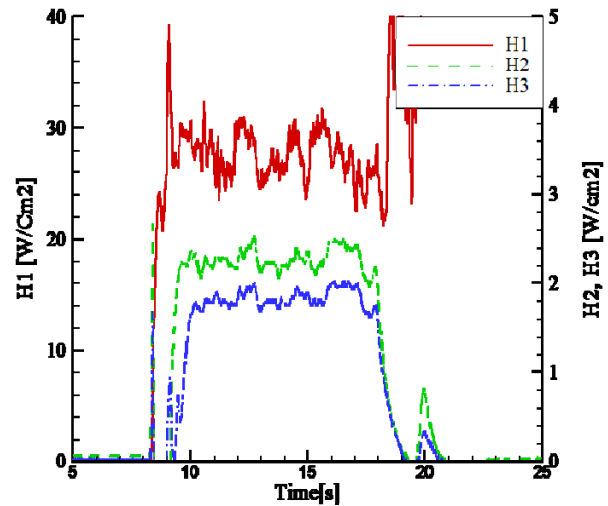


Fig. 4 Heat flux of front side of 18 mm protuberance

References

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