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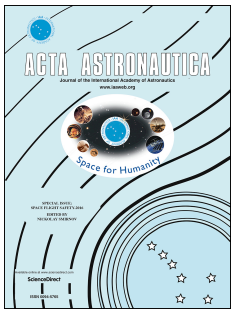

Effect of surface roughness on the heating rates of large-angled hypersonic blunt cones

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Effect of surface roughness on the heating rates of large-angled hypersonic blunt cones

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ABSTRACT

Surface-roughness caused by the residue of an ablative Thermal Protection System (TPS) can alter the turbulence level and surface heating rates on a hypersonic re-entry capsule. Large-scale surface-roughness that could represent an ablated TPS, was introduced over the forebody of a 120^0 apex angle blunt cone, in order to test for its influence on surface heating rates in a hypersonic freestream of Mach 8.8. The surface heat transfer rates measured on smooth and roughened models under the same freestream conditions were compared. The hypersonic flow-fields of the smooth and rough-surfaced models were visualized to analyse the flow physics. Qualitative numerical simulations and pressure measurements were carried out to have an insight into the high-speed flow physics. Experimental observations under moderate Reynolds numbers indicated a delayed transition and an overall reduction of 17 to 46% in surface heating rates on the roughened model.

Keywords: Re-entry**,** Hypersonic, TPS, Heat-transfer, Surface-roughness, Transition-delay.

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