Paper ID: 6559
student

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Specialized Technologies, including Nanotechnology (8)

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AN EXPERIMENTAL INVESTIGATION OF RADIATION OVER AN ABLATING STARDUST MODEL AT 9.8 KM/S

Abstract

It is envisaged that future Lunar and Mars return spacecraft will re-enter Earth's atmosphere at speeds above 11 km/s. The heating environment is extreme at these speeds, necessitating well-designed thermal protection systems (TPS). Ablative TPS have demonstrated superiority over other forms of TPS under these conditions. During the ablative portion of the flight, the ablator is heated and erodes, emitting pyrolysis gases and solid particles. This injected material is known to shield convective heat transfer to the spacecraft, however little is known of its effect on radiative heat transfer. Recent computational studies have found the effect of ablation on radiation varies throughout the electromagnetic spectrum, with a reduction in radiation in the ultraviolet and an increase in the infrared. This paper presents the results of experiments measuring radiation in an ablating shocklayer over a Stardust model at 9.8 km/s in the X2 expansion tunnel at The University of Queensland.