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Nitric oxide emission spectroscopy measurements in a hypervelocity post-shock flow field[1] ANDREW SWANTEK, JOANNA AUSTIN, University of Illinois at Urbana Champaign — In hypervelocity flight conditions, typical of sub-orbital and reentry trajectories, the coupling between the fluid mechanics and the thermochemistry of the flow becomes important. In the current work, we use an expansion tube facility to accelerate air to hypervelocity test conditions (stagnation enthalpy 8MJ/kg, velocity 3.8 km/s). A double wedge model is used to generate an oblique shock, a strong bow shock, and a shock-boundary-layer interaction which is known to be very sensitive to the thermochemical state of the gas. We investigate the nitric oxide emission signal in the ultraviolet region (220-255 nm, A-X transition) at four spatial locations downstream of the bow shock (0, 2, 4, and 6 mm). An in-house code is used to simulate the spectrum in this region and thus obtain a temperature fit. Temperatures are observed to decrease when traversing downstream, starting at approximately the frozen temperature (about 7700 K) at the location of the shock (0 mm). The furthest downstream point deviates from this trend, potentially due to heating in a shear layer formed in the flow field. The flow field is seen to be in non-equilibrium in this region, as temperatures do not reach the equilibrium temperature (about 3900 K).

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