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The Anatomy of a Shock-Boundary Layer Interaction in Hypervelocity Flow[1] ANDREW KNISELY, University of Illinois - Urbana, ANDREW SWANTEK, Argonne National Laboratory, JOANNA AUSTIN, University of Illinois - Urbana — We examine laminar shock-boundary layer interaction over a double wedge geometry in hypervelocity flow. The macroscopic features of this configuration have been shown to be sensitive to the thermochemical energy exchange occurring on a molecular scale. In the current work, an expansion tube is used to accelerate air and nitrogen gas to hypervelocity flow conditions (3.8 km/s, 8.0 MJ/kg) over a 30-55 degree double wedge model. To examine the response of the gas dynamic flow features to real gas effects, we "tune" the chemical composition (O2 content) of the freestream by varying the relative ratio of nitrogen gas and air in the initial test gas. High speed schlieren and chemiluminescence (100k fps) are used to produce overlaid images that visualize the flow structures and identify regions of increased thermochemical activity. These qualitative data are combined with quantitative, pointwise NO vibrational temperature measurements made in the A-X transition band (220–255 nm) to investigate regions of interest such as behind the bow shock and in the shear layer. A transition in bow shock standoff distance and post-shock temperature profiles is identified at 50% O2 content.

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Andrew Knisely
University of Illinois - Urbana

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