ADVANCED THERMAL PROTECTION SYSTEMS (TPS) AND TRANSITION ANALYSIS: UNIQUE EXPERIMENTAL CAPABILITIES AND CURRENT RESEARCH EFFORTS AT THE UNIVERSITY OF TEXAS AT ARLINGTON

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A unique experimental capability in the academic panorama is the *1.6* MW-class arc-jet facility located at the *A*erodynamics *R*esearch *C*enter of the University of Texas at Arlington. The arc- heated wind tunnel has recently been refurbished and repurposed (extended testing time of the order of minutes and testing gas-composition control) for the study and characterization of the aerothermal response of TPS candidate materials for sustained hypersonic flight.

The newly modified facility has been extensively used to support two recent screening and characterization projects for *C*arbon-*C*arbon *A*dvanced *T*echnologies (*C-CAT*): a material characterization for the *SWEAP* program sponsored by *ONR* and a project on advanced TPS sponsored by *AFRL* (ITAR- restricted technical data).

A detailed characterization of the high-enthalpy plume is being performed with a null-point calorimeter obtained from NASA Ames Research Center. Tests with a TEFLON probe are planned to investigate the uniformity of the flow for selected configurations.

Current research interests include the study of the effects of finite Damkohler number on supersonic transition over realistic surfaces in active and passive oxidation regimes. The emphasis is on the analysis of transition bypass over axisymmetric geometries.

A separate study is focused on novel applications of transpiration cooling for C-C/SiC materials. The experimental investigation will leverage on *IR thermography* and *spectroscopy* to examine the effects of transpiration on the material response of a test article subjected to the high enthalpy flow. To accommodate specific properties of the fluid medium used in transpiration, the carbon- carbon TPS material will require custom tailored values of porosity.

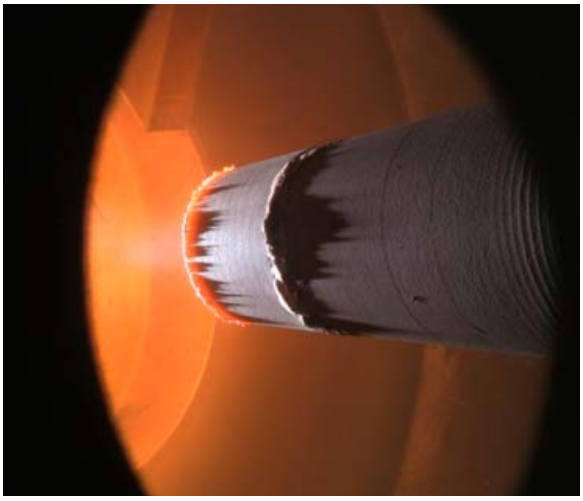

Figure 1: Material article during arc-jet testing (UTA Arc-Heated Facility)

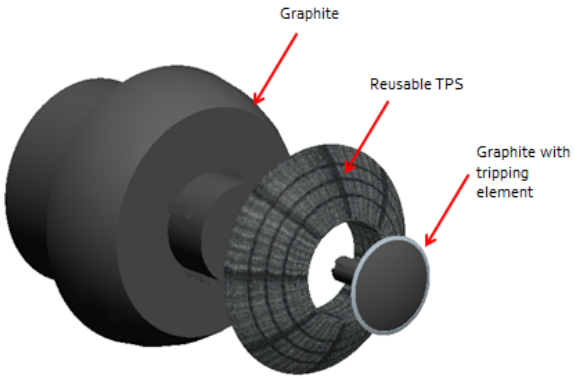

Figure 2: Bypass transition with tripping elements