

Project Title: Development of experimental measurements for high-enthalpy plasma wind tunnel testing

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Project Description: The commissioning of a new inductively coupled plasma (ICP) wind tunnel is underway at the Aerodynamics Laboratory of the University of Illinois. The new facility will enable testing of aerospace materials at extreme conditions, such as those experienced during hypersonic re-entry into the Earth atmosphere. Compared to arc-driven wind tunnels that are usually contaminated by electrode sputtering, the ICP technology allows for the generation of impurity-free high-enthalpy flows. These enable a chemically superior environment, ideal to study gas-material interaction phenomena, such as surface catalysis or ablation (example of a test shown in Figure 1). Several activities are being performed as part of the facility development, including the design of the main wind tunnel components and the development of intrusive and optical instrumentations. This project will support the implementation of a new acquisition system that allows real-time recording and visualization of heat flux measurements. It will also investigate the performance and chemical stability of different heat flux sensors used in the characterization of plasma conditions, an unsolved challenge in the testing practice in high enthalpy facilities. The topic is highly relevant to large scale arcjets in use at NASA and the Air Force for testing large components and materials of hypersonics system. The project will provide the student a unique opportunity to learn a series of experimental measurement and data analysis techniques, often used in experimental aerothermodynamics.

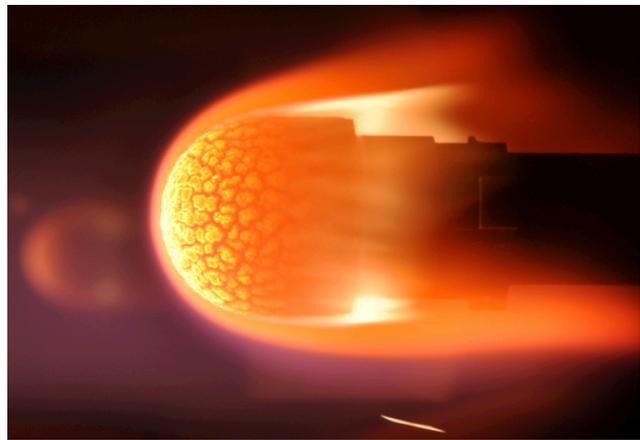


Figure 1. Ablation test in the Plasmatron facility at VKI.

Student background and expected research activities: We are seeking a highly motivated student who is interested in experimental wind tunnel research. Previous experience with intrusive and optical diagnostic methods is desired but not necessary. LabView programming skills are desirable.

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