Technische Universität Braunschweig

Institut für Strömungsmechanik

Call for HiWis with a potential for a future student thesis or studienarbeit in:

Nanoparticle Injection: An Alternative Active Cooling Technique for Hypersonic Flows

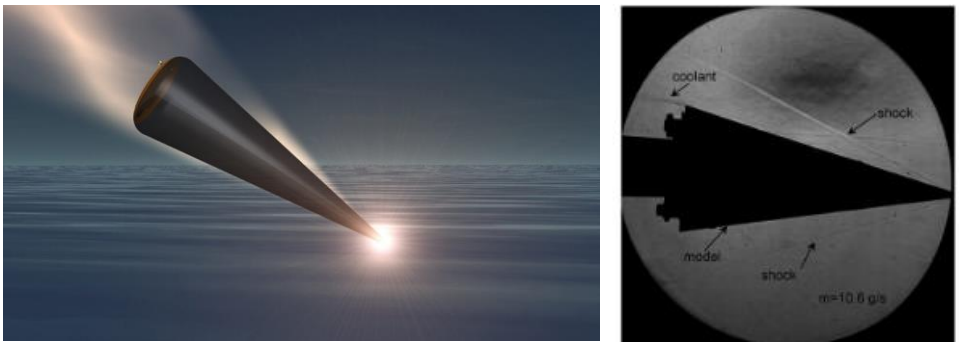
During re-entry, space shuttles encounter a scorching amount of heat, thereby necessitating a high amount of heat shielding. In order to reduce the heat shield's mass, active or passive cooling systems must be employed, which can result in the efficient utilization of resources and effective achievement of the desired goals. For example, investigations into helium-based sonic injection [1], air-based supersonic injection [2], and liquid injection [3] at varying mass flow rates and pressure ratios can result in significant temperature reductions. Metallic particles can provide further advantages than liquids and gases, as they exhibit extremely large heat capacities and can absorb heat through melting and evaporating.

Towards exploring the possibility of solid nanoparticle injection as a cooling strategy at hypersonic speed, the ISM initially plans to investigate the proposition numerically through commercial software. Simultaneously, preliminary experiments are being developed to build up towards a final test to assess this method of heat load alleviation. As such the ISM are seeking hand-on, design-driven students to:

1. Assist in the experimental setup of the hypersonic wind tunnel.
2. Perform basic shock experiments involving Schlieren to assess the fidelity of the facility in producing reproducing results.

Promising students will be invited to continue their work in the form of a student thesis or studienarbeit on the same topic.

Interested students should contact either Dr. Giuseppe Rosi (giuseppe-antonio.rosi@tu-braunshcweig.de) or Dr. Michael Hilfer (michael.hilfer@tu-braunschweig.de) for further details.



(Left) A conical re-entry vehicle under extreme heat during reentry. (Right) A schlieren experiment assessing the efficacy of injected coolant to alleviate heat loads [3].