SETUP OF A SIDE-ARM TECHNOLOGY AND DIAGNOSTICS AT IPG6-B TO CREATE DIFFERENT PLASMA DENSITIES FOR INVESTIGATIONS IN DUSTY PLASMA ENVIRONMENTS

C. Gomringer¹,², M. Dropmann¹,², S. Peters¹,², G. Herdrich¹,², F. Hammer², M. Cook¹, J. Schmoke¹, R. Laufer¹,², T. W. Hyde¹

¹CASPER(Center for Astrophysics, Space Physics and Engineering Research), One Bear Place 97310, Baylor University, Waco, TX 76798
²Institute of Space Systems (IRS), Universität Stuttgart, Pfaffenwaldring 31, 70569 Stuttgart, Germany
RE_Christoph_Gomringer@baylor.edu

Introduction: As a collaborative research project of Baylor University and the University of Stuttgart, Germany, an inductively-heated plasma generator IPG6-B has been developed at the Center for Astrophysics, Space Physics and Engineering Research (CASPER). With its subsystems IPG6-B provides various environmental conditions for research in the fields of dusty plasma, catalysis, atmospheric entry and even terrestrial applications.

Light Gas Gun: When attached to the IPG6-B, the CASPER light gas gun (LGG) provides a one stage dust accelerator that can create a dusty plasma where particles are both changed and accelerated.

Side-Arm Technology: To lower the atomic gas concentration, a side-arm will be used as a subsystem of the IPG6-B. A diffusion tube will be connected as a side-arm at a perpendicular angle to the main flow tube. Dissociated species flow past the opening of the side-arm will allow reactants to diffuse into the tube. Due to surface reactions with the walls, the reactants are progressively removed from the gas phase, establishing a decreasing species concentration profile over the length of the side-arm tube.

Diagnostics: In addition to a calorimeter, pressure gauge and pitot probe, a VacuSen Oxygen Sensor will be employed as a primary diagnostic for the IPG6-B. VacuSEN is a unique miniaturized sensor system that was developed at the University of Stuttgart based on the space experiment FIPEX on board of the International Space Station (ISS). VacuSen enables measurements of both the molecular and atomic oxygen concentrations inside the plasma chamber. Due to space driven miniaturization and reference free measurement principles, this robust ceramic sensor can also be used for in-situ time resolved measurements.

Application Areas: Combining side-arm technology with the VacuSEN System offers the opportunity to collect data determining oxygen concentrations along the side-arm. By placing a sample into the tube, the change in oxygen concentration, before and after the sample is introduced, can be measured. Depending on the concentration, the catalytic surface properties of the sample material can then be calculated. This allows for the...
reproduction of plasma conditions with relevance to both aerothermodynamics and plasma environments in space. It also allows investigation of ambient plasma properties common in different orbits, e.g. Low Earth Orbit (LEO), which is of major interest for investigations into space degradation effects on satellite hardware. Finally, for future exploration missions to the Moon as well as to comets and asteroids, side-arm technology allows for the reproduction of the very low plasma densities existing in lunar atmosphere or in the dusty plasma tails of comets.