HEAT FLUX GAUGE CALIBRATION USING THE BLACKBODY

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In the space exploration the atmospheric re-entry is a phase of great interest for the extreme aerothermodynamic conditions under which the space vehicles are solicited. For such a reason the development of tests in ground facilities for the simulation of the environment re-entry are necessary. An example of simulator are the Plasma Wind Tunnels SCIROCCO and GHIBLI at CIRA (Italian Aerospace Research Center). The model to be tested is installed in the test chamber where the interaction with the hypersonic plasma of air occurs. The experimental characterization of the hypersonic plasma is essential to appreciate what are the test conditions.

The heat flux distribution on the model surface is usually measured by dedicated sensors of the Gardon gauge type, that are installed on the surface to be tested. A very important aspect of the heat flux sensors operation is their calibration and the determination of the measurement accuracy that is evaluated during the sensors calibration.

Unfortunately, CIRA does not have heat flux source. Hence, this paper shows a calibration procedure performed by using a black body as heat flux source for the calibration of Gardon gauges with the range 0-250 kW/m2. The analysis of the system accuracy has been performed with the application of the “uncertainty propagation law”. Moreover, a CFD analysis has been developed to determine the radiative component of the total heat flux measured by the sensors.

Figure 1 –Blackbody calibration source facility