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# SPECTROSCOPIC EMISSION STUDY OF METEORITE ABLATION DURING EARTH ENTRY EXPERIMENTAL SIMULATION PERFORMED IN PLASMA WIND TUNNEL

**Abstract**

There is increasing interest in the analysis of potentially hazardous asteroids and their atmospheric entry scenario that has led aerothermodynamic engineers to investigate meteor entries by applying experimental on-ground investigations and engineering tools typically developed for the earth re-entry of space capsules. The phenomena of meteorites entering the atmosphere, although frequent, are not easy to analyze, especially because of their short time of interaction with atmosphere. For these purposes, experiments performed in the plasma wind tunnels simulating the conditions for the entry of meteorites into the earth atmosphere represent a good way for a better understanding of this kind of phenomena. For this purpose, experimental simulation of meteorites atmospheric entry has been carried out at CIRA in Ghibli PWT facility, a hypersonic plasma wind tunnel supplied by dry air and argon flow heated by a 2MW segmented arc-heater. These experimental simulations allow to observe the morphological changes related to the interaction process between plasma and solid surface and to perform spectroscopic investigations in order to collect and analyze the emission spectra of the radiation emitted in the process. Several chondrites have been tested in order to capture the spectral signature related to the ablation of the materials. A spectrometer composed of a Horiba HR460 monochromator and a Synergy-CCD was used to detect the emission spectra. The spectrometer is connected through a single-mode optical fiber to a UV-Visible objective accommodated next to the quartz window constituting the optical access to the test chamber in order to focus the fragment of the meteor. In the first test, the ablation of a meteor sample was characterized for an extended duration using a grating with 1200 gr/mm and covering the spectral range 200-900 nm with an integration time of 1 sec in about 75 seconds due to the mechanical

movements of the high-resolution grating. A spectral band was observed between 585 and 595 nm. In the second test the ablation of another meteor sample was characterized for a duration of about 18 s, covering the spectral range 570-610 nm with an integration time of 2 sec in about 8 seconds. In the following tests a grating with 100 gr/mm allowed to make acquisitions of the range 300-870 nm with an integration time of 1 s in about 2 seconds, capturing multiple spectra during the ablation of the meteor samples. The analysis and the interpretation of the experimental results is discussed in the present work.