

MATERIALS AND STRUCTURES SYMPOSIUM (C2)  
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EMISSIVITY ANALYSES OF MATERIALS CANDIDATE FOR EARTH'S ATMOSPHERE RE-ENTRY  
FROM SPACE MISSIONS

**Abstract**

Experiments are in course of development at CIRA Laboratories for the experimental determination of the surface emissivity of materials candidate for thermal protection systems of re-entry vehicles from space missions. The proper knowledge of the surface emissivity is a very important task during the development of tests in ground facilities as plasma wind tunnels when the use of optical instrumentation is required for the surface temperature measurements. In fact, due to the very high temperatures generated in the shock layer surrounding the bow of the space vehicle during the re-entry in the Earth's atmosphere the chemical reactions occurring at surface change the nature of the material used as thermal protection system, give rise to a new material named "char zone", whose properties are different from the ones of the below virgin material. So, when the use of optical devices as thermocameras or pyrometers is necessary for the measurement of the surface temperature, the proper knowledge of the material emissivity is also necessary. Hence, to pursue such a target, the investigation of the emissivity characterization has been performed by using a system of pyrometers, of single and dual color types, pointing to the same area of a sample located inside a blackbody used as heater source. For the sake of the analysis the most important parameter is the real temperature at the surface of the sample. To match such a target a K-type of thermocouple has been inserted inside the sample in order to measure its inner temperature when the steady state condition is achieved (the thermal equilibrium of the sample). Thus, the combined use of different types of pyrometers makes possible the experimental evaluation of the emissivity by means of the comparison between the temperature values measured by dual color pyrometers and single color ones.