

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Vehicles – Mechanical/Thermal/Fluidic Systems (7)

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THE INTERACTIVE MECHANISM RESEARCH OF HEAT ENVIRONMENT AND THERMAL
PROTECTION MATERIAL

Abstract

Since the hypersonic flight vehicle has come out, the thermal protection technology was a key problem for the flight vehicle design. The thermal protection mechanism was the principle importance in various types of aircraft's thermal protection technology. The thermal protection mechanism is the interactive mechanism of thermal environment and thermal protective materials. Scientist have explored many kinds of thermal protection mechanisms and developed multiple thermal protective materials for the difference of each kind of flight vehicle's thermal environment (the heat flux from several dozens kw/m² to several million kw/m², stagnation pressure from 0.01KPa to 1 2MPa, aerodynamic heating time from several dozens second to several thousands second). In order to characterize the thermal protection performance of multiple materials, engineers have developed many kinds of ground test equipment to provide the appropriate testing tools. To ensure that the flight test of the maximum probability of success, on the basis of summarizing the experiences and lessons of all types of aircraft flight tests successes or failures, researchers are studying and designing thermal protection performance of multiple materials assessment and evaluation platform in the flight test conditions. Based on summarizing the existing aircraft thermal protection mechanism, this paper proposed that the interactive mechanism of thermal environment and thermal protective materials is not only the rational testimony of scientific connotation for aerothermodynamics, but also is the source and power to promote the development of aerothermodynamics subject. Its research contents include: the characteristics analysis of aircraft thermal environment the thermal protection mechanism and performance prediction thermal protection performance of materials ground tests and the assessment and verification for thermal physical properties of materials. The correlative investigation of the thermal protection mechanism of materials ground tests confirmation and flight state show that the thermal environment and thermal protective material interaction mechanism is a long-term research topics, which is the most active research branch of aerothermodynamics. With the aircraft performance continuous improvement and innovative thermal protection concepts continual emergence, thermal environment would be diversified. The manifold thermal protective materials will be developed for the different thermal environment. The study of interactive mechanism of thermal environment and thermal protective materials would be a much more attractive research topic.