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

Author: Prof. Oleg Alifanov
Moscow Aviation Institute, Russian Federation

Mr. Sergey Budnik
Moscow Aviation Institute, Russian Federation
Prof. Aleksey V. Nenarokomov
Moscow Aviation Institute, Russian Federation
Mr. Andrey V. Netelev
Moscow Aviation Institute (State Technical University), Russian Federation

DESTRUCTIVE MATERIALS THERMAL PROPERTIES DETERMINATION WITH APPLICATION FOR SPACECRAFT STRUCTURES TESTING

Abstract

An experimental-computational system is presented for investigating the thermal and kinetics properties of composite materials by methods of inverse heat transfer problems and which is developed at the Thermal Laboratory of Department Space Systems Engineering, of Moscow Aviation Institute (MAI). The system is aimed at investigating the materials in conditions of unsteady contact and (or) radiation heating over a wide range of temperature changes and heating rates in a vacuum, air and inert gas medium. The paper considers the hardware components of the system, including the experiment facility and the automated system of control, measurement, data acquisition and processing, as well as the aspects of methodical support of thermal tests. In the next part the conception and realization of a computer code for experimental data processing to estimate the thermal and kinetics properties of materials are given. The general method of iterative regularization is concerned with application to the estimation of materials properties. Such problems are of great practical importance in the study of material properties used as destructive surface coating in objects of space engineering. In the third part are given the results of practical implementation of hardware and software presented in previous two parts for the estimating of thermal properties of destructive materials. The main purpose of this study was: to confirm operability and effectiveness of the methods developed and hardware equipment for determining thermal properties of particular modern materials. The physical and mathematical model of heat transfer processes in the experimental specimens of thermal materials are given. Mathematical formulations of the corresponding IHCP are also presented. The requirements are formulated to experimental specimens, parameters and testing conditions. Developed are a scheme of thermal tests and a test technique.