Paper ID: 45105
oral

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Specialised Technologies, Including Nanotechnology (8)

Author: Dr. Alena V. Morzhukhina
Moscow Aviation Institute (National Research University, MAI), Russian Federation

Prof. Oleg Alifanov
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
Mr. Ivan A. Rudoi
Moscow Aviation Institute (National Research University, MAI), Russian Federation

IDENTIFICATION OF THE MATHEMATICAL MODEL FOR NON-EQUILIBRIUM THERMOCHEMICAL KINETICS OF DESTRUCTIVE POLYMERIC MATERIAL FOR DESCENT VEHICLES THERMAL PROTECTION

Abstract

At the present day, the destructive polymeric materials are widely used in the structures of heat-loaded elements in a variety of technical fields. Such materials are indispensable as frontal brake screens of vehicles entering the atmosphere with a second space velocity, such as “Hayabusa” or “Stardust”. A phenolic-carbon composite was used as the material for thermal protection in these spacecraft. The process of destruction in such materials has a complex multi-stage nature. Chemical reactions between the components of the decomposing material and the components of the oncoming stream may proceed in parallel with the release and absorption of heat. In engineering practice, when designing destructive thermal protection, the use of such models with parallel multi-stage processes, can significantly complicate the process of choosing the optimal technical solution. In such situations, to describe the process of destruction, the one-stage Arrhenius equation does not quite fit. The accuracy of the mathematical model can be increased by introducing a component, which takes into account the heating rate. This work is devoted to the development of an algorithm for calculating the coefficients of the non-equilibrium thermochemical kinetics equation by the inverse problem method. The developed algorithm is based on the solution to the coefficient inverse problem with the help of iterative regularization method. The use of the iterative regularization method based on its good convergence and universality, which is confirmed in practice by solving similar problems.