The main objective of this work is to give more information on the influence of the experimental conditions to the estimated thermal properties of ablative composite materials.

Two kinds of experiments with the phenolic-composite samples instrumented with in-depth located thermocouples have been carried out. In the first, the sample has been exposed to intensive thermal load from acetylene flame, and in the second, the sample has been incorporated in the rocket nozzle. Obtained transient temperature responses have been used to estimate unknown thermal properties.

Transient one-dimensional partial differential equations with two moving boundaries and decomposition equations have been used to describe complex process of simultaneous heat and mass transport within material and from its surface to the surroundings caused by a number of mechanisms accompanied with a lot of other physical and chemical processes. The complete set of equations has been solved numerically using explicit finite-difference scheme. Double coordinate transformation has been applied to eliminate moving boundaries, and to increase the number of grid points in the regions of higher temperature gradients.

Newton-Raphson’s and steepest descent methods have been combined in order to minimize the mean squared difference between the model prediction and experimental response.

Good match between predicted and measured temperatures confirmed validity of the proposed ablation and nonlinear optimization models.

The estimated parameters in the two cases show good agreement and it can be concluded that investigation of ablative composite materials can be successfully carry out with acetylene experimental setup.