

Measurement Inaccuracy of Temperature Profile in Solid Propellant by Thermocouple

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Abstract: Some results of numerical 3-D modeling of temperature gauged in burning solid propellant (SP) by an inserted thermocouple are considered. Subsurface thermocouple sensors are very important technical devices employed to gauge heat fluxes in burning SP. Incidental problems related to the accuracy of the sensors temperature data may appear. The major source of inaccuracy is the difference in thermophysical properties of the thermocouple and of the SP. The significant difference in the values of heat thermal conductivity coefficients of SP and thermocouple material results in the heat flow along thermocouple wires inside the SP that substantially changes seal thermojunction temperature so thus misrepresenting thermocouple data. A numerical solution of 3-D equation of heat conduction equation is found through the method of finite volumes, which allows to apply arbitrary meshes.

Numerical simulation has shown that the inaccuracy of temperature measurements in SP by thermocouple may be highly and the discrepancy is dependent on both the burning velocity and the geometric scale of the thermocouple. The results obtained can be used for correcting the temperature measurement by thermocouples of SP.

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