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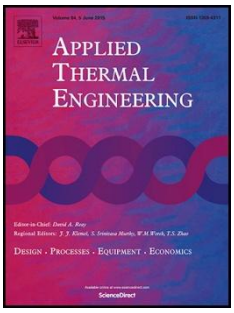

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Fast response Co-axial Thermocouple for Short Duration Impulse Facilities

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Highlights

- A fast response co-axial thermocouple is realized for short impulse facilities.
- The behavior of the thermocouple is very similar to the imported thermocouple.
- The response time of the sensor is found to be 3µs.
- The measured stagnation heat flux closely matches with the theoretical prediction.
- The thermocouple is robust and can be contoured to any type of models.

ABSTRACT

A fast response Chromel-Alumel (K-type) co-axial thermocouple is designed, fabricated, calibrated and tested in a shock tunnel. The freestream Mach number of 5.75 and the total enthalpy of 0.92 MJ/kg is simulated to study the stagnation point heat flux of a hemi spherical model through transient temperature trace. The realized K-type co-axial thermocouple of 3mm in length and 1.6mm in diameter is flush mounted at the stagnation point of a 7.5 mm radius hemi-spherical model. The achieved response time of the realized K-type co-axial thermocouple is ~3µs which is sufficient enough to capture the transient temperature signal. A steady tunnel flow time of 1.8 millisecond is used to get the average stagnation point heat flux. The measured stagnation point heat flux is 22.96 W/cm^2 which is well matched with the Fay-Riddell value within 5.5%. The realized K-type co-axial thermocouple is robust and fast response, can be contoured to any type of model surface.

Key words:

K- type co-axial thermocouple, fast response, shock tunnel, hypersonic flow, Fay-Riddell, Stagnation point heat flux

Nomenclature

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