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**Development of thin film thermocouples on ceramic materials
for advanced propulsion system applications**

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Thin film thermocouples have been developed for use on metal parts in jet engines to 1000°C. However, advanced propulsion systems are being developed that will use ceramic materials and reach higher temperatures. The purpose of this work is to develop thin film thermocouples for use on ceramic materials. The new thin film thermocouples are Pt13Rh/Pt fabricated by the sputtering process. Lead wires are attached using the parallel-gap welding process. The ceramic materials tested are silicon nitride, silicon carbide, aluminum oxide, and mullite. Both steady state and thermal cycling furnace tests were performed in the temperature range to 1500°C. High-heating-rate tests were performed in an arc lamp heat-flux-calibration facility.

The fabrication of the thin film thermocouples is described. The thin film thermocouple output was compared to a reference wire thermocouple. Drift of the thin film thermocouples was determined, and causes of drift are discussed. The results of high heating rate tests up to 2500°C/sec are presented. The stability of the ceramic materials is examined.

It is concluded that Pt13Rh/Pt thin film thermocouples are capable of meeting lifetime goals of 50 hours or more up to temperatures of 1500°C depending on the stability of the particular ceramic substrate.

SUBJECT INDEX- Thin film sensors; noble metal thermocouple; high temperature thermometry.