NASA TECH BRIEF

High-Temperature, Long-Term Drift of Platinum–Rhodium Thermocouples

Thermocouple drift during long-duration use at high temperature can be a serious problem. A thermocouple drift of 55°K at 1500°K in 150 hours has been observed. Such thermoelectric-power changes normally occur with noble-metal thermocouples due to contamination of the thermocouple wire by a change in the amount of lattice defects or by grain growth. An investigation was made in which contamination of the thermocouple wire by impurities was minimized. Pure alumina insulators were used to minimize contamination from this source. A controlled low-impurity-level high-vacuum environment (mean nitrogen equivalent pressure of 3×10^{-8} torr) was used to minimize contamination from the environment.

In the investigation, the average thermal electromotive force change for 87% platinum–13% rhodium/platinum thermocouples was -2.8°K after 3700 hours exposure to a mean temperature of 1530°K. For most engineering applications, a change so minor is negligible. If impurities can be kept from contaminating the thermocouple, thermoelectric-power drift can be held to small values.

Notes:

1. The principles used in this investigation and the results can serve as guidelines for the design and use of other thermocouple devices requiring a stable thermoelectric power.
2. The following documentation may be obtained from:

   Clearinghouse for Federal Scientific and Technical Information
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.65)

   Reference:
   NASA-TN-D-5287 (N69-29196), Thermal Electromotive Force Change for 87Pt13Rh/Pt Thermocouples in 1530°K, 10^{-8} Torr Environment for 3700 Hours
3. Technical questions may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: TSP70-10552

Patent status:

No patent action is contemplated by NASA.

Source: A. J. Szaniszlo
Lewis Research Center
(LEW-11111)

Category 01,03