Enclosure 4 to E-37324

Three Thermal Conductivity Measurement Reports for Certain Neutron Absorber Materials, performed by Precision Measurements and Instruments Corporation (public versions)

Non-Proprietary

TRANSNUCLEAR INC.

PURCHASE ORDER NUMBER 2006-0310

THERMAL CONDUCTIVITY MEASUREMENTS OF AL 1100 / B4C COMPOSITE SPECIMENS

April 13, 2007

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THERMAL CONDUCTIVITY MEASUREMENTS OF AL 1100 / B4C COMPOSITE SPECIMENS

WORK CONDUCTED FOR TRANSNUCLEAR INC.
PURCHASE ORDER NUMBER 2006-0310

April 13, 2007

Precision Measurements and Instruments Corporation (PMIC) measured the thermal conductivity of 3 Al 1100 / B4C composite specimens. This work was performed per purchase order 2006-0310, dated 12/5/06. The in-plane measurements were performed with a guarded-comparative-longitudinal heat flow technique based on "ASTM standard E-1225". Results are presented in the following table.

Personnel Involved in Testing

Ann Gaidos-Morgan, Test Technician 3, PMIC
Don Schneider, Quality Assurance, PMIC

Specimen Description

Transnuclear Inc. provided the following specimens:

Specimen ID	Description	Nominal Length*	Nominal Width*	Nominal Thickness
1	Al 1100 / B4C composite #308A	2"	1"	0.170"
2	Al 1100 / B4C composite #403B	2"	1"	0.170"
3	Al 1100 / B4C composite #182A	2"	1"	0.170"

*Dimension after machining

Test Procedure

- Specimen Check-In

The specimens were received on March 30, 2007, via UPS. The specimens were inspected for damage. No shipping damage was observed. The specimens were labeled and stored at room temperature in a secure environment prior to measurements.

- Specimen Preparation

From each section of original material a coupon measuring 1" wide by 2" long was machined. Thermocouple holes were drilled at the appropriate locations on the side surface. The end and side surfaces were lightly sanded to improve the flatness, parallelism and perpendicularity. The specimens were tested in the length direction. A Specimen Inspection Data Sheet was used to record the dimensional inspection.

- Calibration Standard Inspection

A Calibration Standard Inspection Data Sheet was used to record the dimensional inspection of the standard. The standard was found to be acceptable and the dimensions were recorded on the supplied Calibration Standard Inspection Data Sheet.

- Meter Bar Inspection

A Meter Bar Inspection Data Sheet was used to record the dimensional inspection of the meter bars. The meter bars were found to be acceptable and the dimensions were recorded on the supplied Meter Bar Inspection Data Sheet.

- Thermal Conductivity Measurements

The thermal conductivity of the specimens was measured at nominal temperatures of 23°C, 125°C, 230°C and 340°C. Electrolytic Iron SRM 8421 meter bars, fitted with thermocouples, were used for heat flux measurement. K-type thermocouples were placed in the appropriate holes for temperature measurement. A small quantity of thermal grease was applied to the tip of each thermocouple to improve thermal grounding to the specimen or meter bars. A thin film of thermal grease was also applied at each interface, between the specimen, adapters, meter bars and hot and cold plates. A uniform compressive load was maintained on the specimen stack during testing. The test apparatus was ramped to the desired temperature and held for sufficient time to reach steady state conditions. The total temperature difference between the upper and lower plates was maintained at 80°C. The tests were performed in vacuum (<100 mTorr). The thermal conductivity testing apparatus was calibrated with a 99.99% pure aluminum reference standard. The data recommended by TPRC (Thermophysical Properties Research Center, Thermal Conductivity, Volume1, Plenum, New York, 1970) were used for the calibration. With the reference material in place of the specimen, a test was run under identical conditions, from which a calibration factor for the meter bars was obtained. The test procedure was recorded on the Test Setup Data Sheet.

- Analysis

Ten minutes of data, after the specimens had stabilized at each desired temperature, were used for the conductivity calculation. The temperature of each specimen and meter bar thermocouple was averaged over this time. The calibration factor obtained from the reference material was applied to the meter bar derived flux to obtain the corrected heat flux.

- Documentation

The record forms listed in the paragraphs above, along with the caliper and thermocouple calibration records, are contained in the DATA PACK, under separate cover.

Thermal Conductivity Test Results

The results are presented in **Table 1**. The thermal conductivity is expressed in W/m-K. The actual specimen temperature is listed on the table.

Table 1, Thermal Conductivity (W/m-K)

Proprietary Information Withheld Pursuant to 10 CFR 2.390

Please contact our technical staff at (541) 753-0607 if you have any questions or require additional information regarding these measurements.

The work was performed by the following personnel:

Ann Gaidos-Morgan
Test Technician

Don Schneider
Project Engineer

Precision Measurements and Instruments Corporation hereby claims that test results are obtained by techniques based on relevant ASTM standards, calibrations with NIST standard reference materials and/or published procedures. Thus, we accept no liability for test results beyond the cost of the contract rendered.