Am/Cm Canister Temperature Evaluation in CIM5

by

M. A. Baich

Westinghouse Savannah River Company

Savannah River Site

Aiken, South Carolina 29808

D. C. Witt

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AM/CM CANISTER TEMPERATURE EVALUATION IN CIM5

The attached document summarizes the results from two CIM5 runs during which glass was poured into stainless steel canisters that were configured with thermocouples to measure the external canister surface temperatures at elevations of 0.50-inch, 3.5-inch and 6.5-inch from the canister bottom. Please refer any questions you may have regarding the contents of this document to M. A. Baich (Ext. 7-7692) or D. C. Witt, (Ext. 7-7754)

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AM/CM CANISTER TEMPERATURE EVALUATION IN CIM5 (U)

M. A. Baich
D. C. Witt

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

SAVANNAH RIVER SITE

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AM/CM CANISTER TEMPERATURE EVALUATION IN CIM5 (U)

**M. A. Baich
D. C. Witt**

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Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

SAVANNAH RIVER SITE

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APPROVALS

Mark Baich
M. A. Baich, Author

1/11/00
Date

D. C. Witt
D. C. Witt, Author

1/11/00
Date

Timothy M. Jones
T. M. Jones, Technical Reviewer

1/10/00
Date

L. F. Landon
L. F. Landon, Manager

1/17/00
Date

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I. INTRODUCTION

To facilitate the evaluation of alternate canister designs, 2 canisters were outfitted with thermocouples at elevations of $\frac{1}{2}$, $3\frac{1}{2}$, and $6\frac{1}{2}$ inches from the canister bottom – see Figure 1. The canisters were fabricated from two inch diameter schedule 10 and two inch diameter schedule 40 stainless steel pipe. Each canister was filled with ~2 kilograms of 49 wt% lanthanide (Ln) loaded 25SrABS glass during 5 inch Cylindrical Induction Melter (CIM5) runs for TTR Tasks 3.03 and 4.03.⁴ Melter temperature, total mass of glass poured, and the glass pour rates were almost identical in both runs. The schedule 40 canister has a slightly smaller ID compared to the schedule 10 canister and therefore filled to a level of 9.5 inches compared to 8.0 inches for the schedule 40 canister. The schedule 40 canister had an empty mass of 1906 grams compared to 919 grams for the schedule 10 canister.

II. SUMMARY

The schedule 10 canister was found to have a higher maximum surface temperature by about 50-100 °C (depending on height) during the glass pour compared to the schedule 40 canister. The additional thermal mass of the schedule 40 canister accounts for this difference. Once filled with glass: each of the canisters cooled at about the same rate, taking about an hour to cool below a maximum surface temperature of 200 °C. No significant deformation of the either of the canisters was visually observed.

III. DETAILS – Canister Temperature Profiles

Two CIM5 runs were made to produce a 49 wt% Ln loaded 25SrABS glass. Figure 2 presents a 5-second average pour rate for each of the two pours. Variations in either pour rate or mass of glass poured are minor. Figures 3 and 4 present the temperature profiles for the schedule 10 and schedule 40 canisters, respectively during the pour. Each of the temperature profiles demonstrated the same basic character: slowly increasing temperature as the glass already poured radiated heat up the canister wall, rapid temperature increase as the glass level reached the level of the thermocouple, and a slow decline as heat was being lost by convection to the outside air.

The schedule 40 canister temperature response was slowed by the larger thermal mass of the canister wall. The increased thermal mass led to a lower maximum temperature of 50–100 °C depending upon the vertical location. Figures 5 and 6 demonstrate the difference. However, once filled with glass the time to cool below 200 deg C was about the same for both canisters.

IV. REFERENCES

1. WSRC-NB-99-00173, **CIM5 Laboratory Notebook**
2. T. M. Jones and D. C. Witt, CIM5 TTR Task 4.02,4.03-Coil Voltage and Insulation Sleeve Temperature Measurement (U), SRT-AMC-99-0213, November 2, 1999.
3. T. M. Jones and D. C. Witt, CIM5 TTR Task 3.03-Interlock Recovery During Drying Phase (U), SRT-AMC-99-0214, November 3, 1999.

Figure 1 Instrumented Am/Cm Canisters

Figure 2 Five Second Average Pour Rate

Figure 3 Schedule 10 Canister Temperature Profile

Figure 4 Schedule 40 Canister Temperature Profile

Figure 5 Schedule 10 Canister Cool Down

Figure 6 Schedule 40 Canister Cool Down

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