Cullet Manufacture Using the Cylindrical Induction Melter

by

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TO: **W. H. MARTIN, 730-2B**

FROM: **L. F. LANDON, 704-1T**

CULLET MANUFACTURE USING THE AM/CM CYLINDRICAL INDUCTION MELTER

The attached document describes the process employed in the Am/Cm Pilot Facility to prepare cullet in response to Task 1.01 of TTR-NMSS/SE-006. The cullet produced in the described manner has been used in the majority of process simulations conducted in the Pilot Facility. Please refer any questions you may have regarding the contents of this document to D. H. Miller (Ext. 7-7007)

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CULLET MANUFACTURE USING THE CYLINDRICAL INDUCTION MELTER (U)

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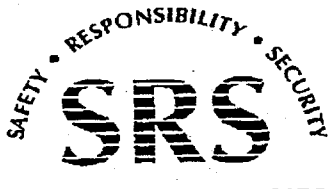

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INTRODUCTION

The base process for vitrification of the Am/Cm solution stored in F-canyon uses 25SrABS cullet as the glass former. A small portion of the cullet used in the SRTC development work was purchased from Corning while the majority was made in the 5 inch Cylindrical Induction Melter (CIM5). Task 1.01 of TTR-NMSS/SE-006, Additional Am-Cm Process Development Studies, requested that a process for the glass former (cullet) fabrication be specified. This report provides the process details for 25SrAB cullet production thereby satisfying Task 1.01.

SUMMARY

The CIM5 was used to produce ~50 kg of cullet for use in TTR testing. Six runs were required to produce the quantity of cullet needed. Glass marbles previously purchased for use in the program were used to produce the cullet. The marbles were melted at 1500 ^{0}C and the molten glass was quenched by pouring into water to produce cullet.

PROCESS DESCRIPTION

Melter Flush

Before the cullet runs were begun, the melter was flushed to clean out the residual glass from previous testing. This was accomplished by charging the melter with 2000 grams of –14/+30 mesh 25SrABS frit. The frit was from Ferro Lot Number 721617. The material was heated at approximately 10 to 15 ^{0}C/min as indicated by the bed thermocouple (T3C). When a set point of 1500 ^{0}C. was reached, the bubbler was inserted at a level 1″ from the bottom of the melter. Argon flow was initiated at 1.5 scfh and an addition of 500 grams of ¼ inch 25SrABS glass beads was made. When the temperature of the bed had recovered, an additional 500 gram charge of beads was made. This process was repeated until the melter contained 6 kg of glass. An interlock occurred during the cycle because of a faulty temperature indication, but temperatures were quickly recovered. A thirty minute soak was used before the pouring cycle was begun. A total of 4 buckets of water were used to capture the glass from the pour. The glass was allowed to cool and was sampled. The material appeared very uniform with only trace amounts of colored glass found in the first portions of the pour. This material was isolated and saved for possible future use.

Cullet Production

After flushing the melter, the cullet for the TTR testing was made over three days, with each run consisting of two 6 kg charges and two 6 kg pours. A typical run is described below. An initial charge of 6000 grams of 25SrABS marbles was made to the melter. The 3/8″ marbles were produced by Corning on purchase order AB93818N. The bubbler was placed in the melter at ¾″

above the bottom of the vessel. The bed thermocouple (T3C) was located 2" off the bottom of the vessel. After a short drying time to remove moisture, the power was ramped on the vessel and vessel bottom to obtain a 10 to 15 ^{0}C/min increase in temperature. When the bed reached 750 ^{0}C, the cover was placed over the melter to reduce radiant heat loss. When the bed thermocouple reached 1500 ^{0}C, a 1.5 scfh flow of argon was introduced through the bubbler. Drain tube power was then initiated at 0.26 kw and ramped at approximately 40 ^{0}C/min. Thirty minutes after the bubbler initiation, the pour cycle was begun. A three gallon stainless steel bucket was filled with 2 gallons of deionized water to catch the glass stream. The buckets were changed when the water started to boil vigorously. This occurred in approximately 10 minutes when 1200- 1400 grams of glass had been poured. A total of 4 buckets were used for each melter charge. Glass accumulated in the bucket was occasionally stirred to prevent a large mound from building up. Pour rates were approximately 10-12 kg/hr, with the rate dropping toward the end of the pour due to reduced static head. When the glass started dripping, tip cooling air was applied and the bubbler was removed. With power levels unchanged, 6000 grams of marbles were added to the melter. The melter was covered immediately. When the temperatures had recovered to 1500 ^{0}C, the bubbler was inserted and argon flow was initiated. Thirty minutes later the second pour cycle was started. The glass was again caught in 4 buckets of deionized water. After pouring, the melter was cooled using the auto cool down cycle. Samples for analysis were collected from each of the pour cycles.

RECOMMENDATION

The cullet produced in this campaign has been used successfully in numerous TTR tests. This process produces a cullet where 100% of the cullet will pass through a US Standard 1-1/4 mesh sieve and less than 5 wt% passes through a US Standard 10 mesh screen. In addition, the cullet is free flowing and has a minimal number of strings or fibers.

ATTACHMENTS

1. Cullet Run Temperature Profile
2. Cullet Run Power Output

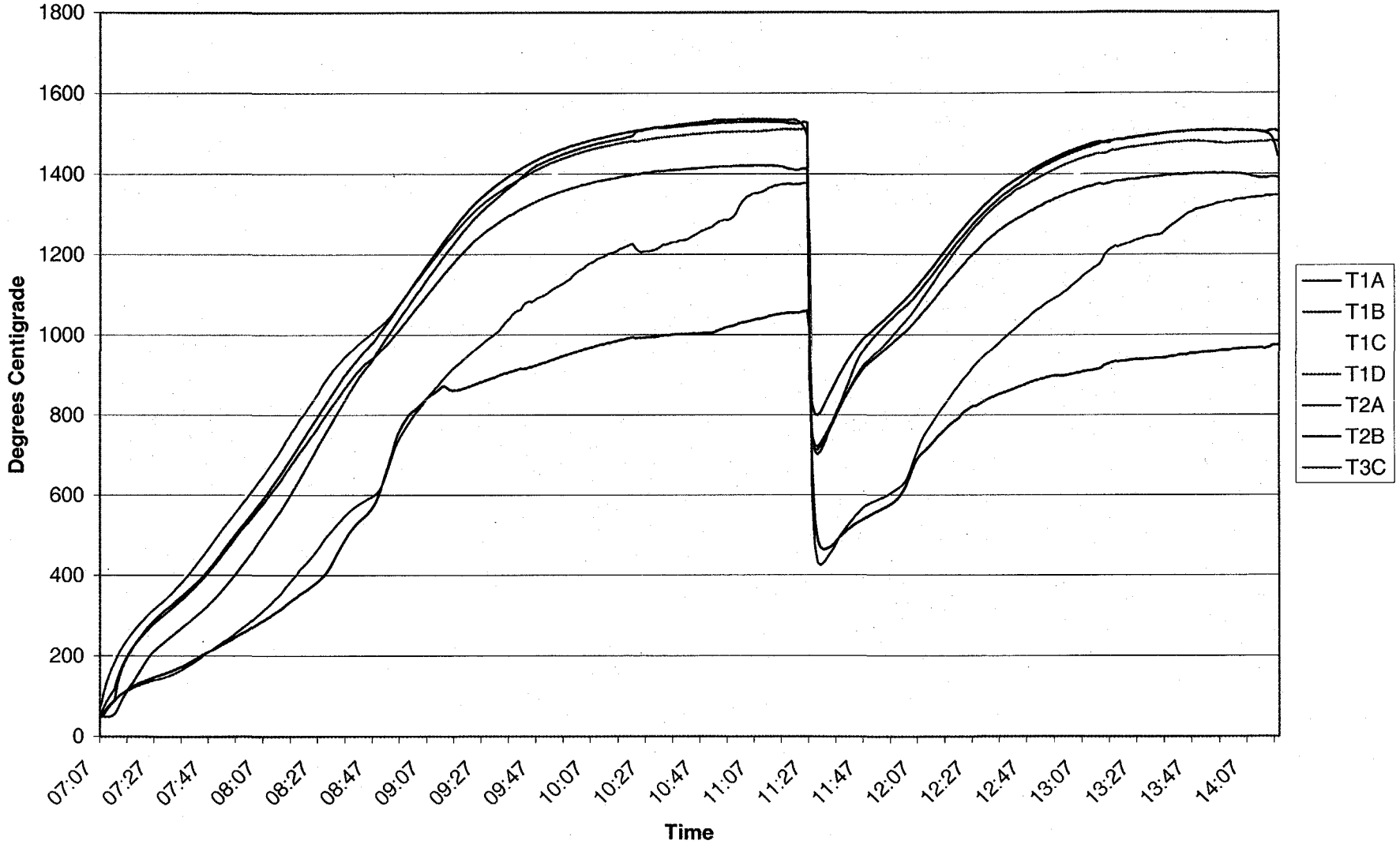
REFERENCES

1. T. M. Jones, D. C. Witt, CIM5 Job Plan to Flush Vessel With 25SrABS Glass From Frit and Marbles (U), SRT-AMC-99-0194, September 21,1999.

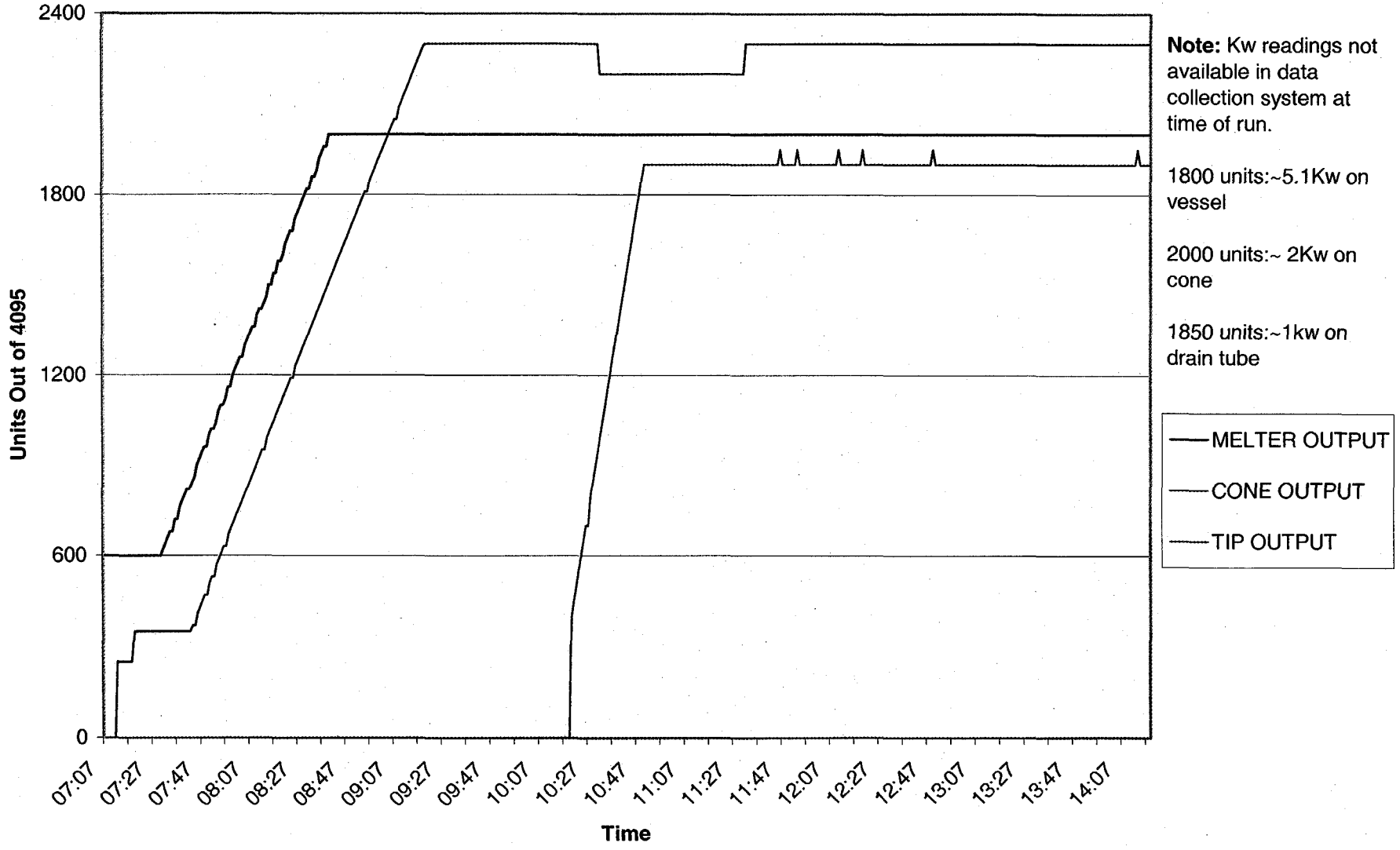
2. T. M. Jones, D. C. Witt, CIM5 TTR Run Plan #1 – Produce Cullet From 25SrABS Marbles (U), SRT-AMC-99-0196, September 22,1999.

3. WSRC-NB-98-00227, 5" Cylindrical Induction Melter Development CIM 5 Laboratory Notebook.

Attachment #1 - Cullet Run Temperature Profile



Attachment #2 - Cullet Run Power Output



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