

Vitrification of Cesium-Laden Organic Ion Exchange Resin in a Stirred Melter

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Tests were conducted using a stirred-tank melter to vitrify nonradioactive, cesium-laden organic ion exchange resin. This resin, which is highly effective in removing cesium from solution, was developed to replace the complex sodium tetrphenylborate precipitation process used on the feed sent to the Defense Waste Processing Facility at the Savannah River Site to remove cesium-137 from a wastewater solution. Lower bound estimates of overall cesium retention in the glass range from 70.5 to 73.9%. Only 2.1 to 4.3% of the cesium was emitted from the melter. Since between 21.8 to 27.4% of the cesium was not recovered or accounted for, the overall cesium retention may have been much higher.

KEY WORDS: Vitrification, ion exchange resins, cesium

INTRODUCTION

High-level radioactive waste (HLW) is the waste resulting from the processing of irradiated nuclear fuel. After ten to twenty years of storage, cesium-137 is one of the major sources of beta and gamma radiation. In the United States, HLW from nuclear weapons programs was neutralized and stored as a sludge with a salt layer and supernatant. Because cesium-137 is water soluble, it partitions to the supernatant instead of the sludge or salt layer, which contain the bulk of the other radionuclides.

At the Savannah River Site (SRS), precipitation using sodium tetraphenylborate (NaTPB) is used to remove cesium from the supernatant so that it can be fed to the HLW melter. Since direct addition of NaTPB would burden the melter with a large quantity of organic material, NaTPB is hydrolyzed and reduced with formic acid to produce a benzene waste requiring further treatment. Organic compounds in the feed promote reducing conditions in the glass. A more reduced HLW glass is often less durable because reduced iron, Fe^{2+} , acts as a network modifier. In contrast, Fe^{3+} is a network former that improves glass durability.

A resorcinol-formaldehyde cation exchange resin was developed at the SRS to remove cesium. Use of this resin would have several advantages over the NaTPB process, including lowering the amount of alkali metals fed to the melter, allowing the boron content of the glass to be more easily controlled, and eliminating the benzene waste stream.(1,2)

A proposed disposal method for spent resin is feeding it with frit and HLW sludge directly to a HLW melter. In preliminary tests, problems occurred in feeding the resin to a slurry-fed melter. The resin formed a crust on the melter's surface increasing the time for incorporation in the melt. The resin also promoted reducing conditions that could increase cesium volatility and result in a less durable glass.(3)

The use of a stirred-tank melter may help overcome these problems. Since the entire melt is mixed by an impeller, crust formation can be prevented. Agitation may also increase oxygen transfer to the melt and avoid a highly reduced glass.

The goal of this research was a feasibility study for vitrifying the organic ion exchange resin in a stirred-tank melter. Tests were conducted to determine the fate of cesium including the feed, exit glass, and offgas streams and to assess any impact of feeding the resin on the melter or its performance.

BACKGROUND

Ion Exchange Process

The cation exchange resin, developed at Savannah River Technology Center (SRTC), has a cesium capacity four times greater than the best commercial resin.(2) If it were to replace the NaTPB precipitate process, it would decrease the complexity of the cesium decontamination process, lower the amount of organic compounds fed to the melter, and eliminate the benzene waste stream.

To determine if this resin could be fed to a melter, Bibler *et al.*(3) used an 18 kg glass capacity, ceramic-lined, Joule-heated melter at a temperature of 1150°C. Three runs were performed. The first run fed simulated sludge and frit 165; the remaining runs fed a mixture of frit 165, sludge, and resin. The schedule for the first two runs consisted of pouring for sixteen hours during the first two days and eight hours during the third day with the melter idling for the remaining hours. The schedule for the third run was a continuous run lasting fifty-three hours. Each run produced about 144 kg of glass.

No effects on melter operation, such as shorting due to conductive species, plugging of the offgas system, or difficulties in pouring the melt, were caused by resin addition. On the other hand, the redox ratio, defined as the ratio of Fe^{2+} to Fe^{Total} in the glass, increased when resin was added. This indicated the glass was becoming more reduced. The glass also was less durable due to feeding the resin. Because the last run did not have an idling period where oxygen could transfer to the melt as in the first two runs, this ratio was highest during the third run.

Overcamp *et al.*(4) performed crucible tests to determine cesium retention in glass feeds containing either activated carbon or resorcinol-formaldehyde resin. They found that the reducing power of the organic resin was approximately four times less on a mass basis than activated carbon. The average cesium retention for glass samples with cesium-laden resin as a reducing agent was 74.7% with a standard deviation of 5.5%. The average cesium retention for glass samples that used activated carbon as a reducing agent was 66.8% with a standard deviation of 5.2%. There was no correlation between the final redox ratio of the glass and cesium retention.

MATERIALS AND METHODS

Equipment

Stirred-Tank Melter

The stirred-tank glass melter used in this research was the Stir-Melter model WV-0.25. A cutaway of the melter is shown in Fig. 1. It was a Joule-heated melter with a 10 kW power supply. The 152 × 152 × 305 mm vessel was constructed of Inconel™ 601. Heating elements with a 7 kW power supply surround the vessel. These auxiliary heaters were used for start-up and to assist in maintaining melter temperatures. An Inconel 690 impeller mixed the glass and served as one electrode in the Joule-heating circuit. The height and rotational speed of the impeller could be varied. Glass-making slurry was fed through ports at the top of the melter vessel and was rapidly incorporated into the melt. When the molten glass had a sufficient hydrostatic head, glass flowed through an opening in the bottom of the tank. Then it flowed upwards through a channel in the corner of the vessel, over a weir located 152 mm from the bottom of the vessel, and then down the drain tube.(5)

Gas Sparging System

In this study, the melter was equipped with a gas sparging system consisting of a 1/4" Inconel 601 pipe. This pipe entered at the top of the melter's tank, ran down along a corner edge, and across the bottom of the melter until it was directly under the impeller. Oxygen from a gas cylinder flowed through the pipe and bubbled beneath the impeller.

Feed System

In the oxygen transfer tests, slurry in a large mixing tank was fed to the melter using a peristaltic pump through a water-cooled slurry feed nozzle. In the tests with resin, slurry from the mixing tank and cesium-laden ion exchange resin were mixed in a 20 L bucket and fed from this bucket to the melter through a water-cooled slurry feed nozzle using a peristaltic pump.

Offgas Control System

A positive-displacement, rotary blower pulled gases evolving from the feed and any air leaking into the melter through a 2" schedule 10 stainless-steel pipe. A sampling port was installed approximately 1 m above the melter. The gases then flowed through a 1" schedule 10 stainless-steel pipe to a spray quencher. Approximately 1 L/min of water was sprayed into the flow to lower the temperature and scrub larger particles. The gas then was bubbled through a perforated pipe into the jet bubbler tank with an operational volume of approximately 92 L. The gas then traveled through a 152 mm diameter countercurrent tower packed to a level of 1.5 m with 12.7 mm glass Raschig rings. The liquid flow to the tower was approximately 4 to 8 L/min. The effluent liquid was pumped back to a 325 L reservoir.

Materials

The slurry provided by SRTC in this research was a HLW surrogate slurry for the SRS Defense Waste Processing Facility (DWPF) melter. The slurry was approximately 35 to 40% by mass solids. It consisted of three components. The first was a surrogate metal oxide sludge (Optima Chemicals, Inc., Douglas, GA) similar to SRS HLW sludge. The second was frit 202 (Cataphote, Inc., Flowood, MS), a borosilicate glass frit. The third was simulated precipitate hydrolysis aqueous (PHA) product. If the ion exchange process replaced the NaTPB precipitation process, PHA material would not be present in the slurry. Except for the small amount of formic acid in the simulated PHA material, no other organic material or carbon was present in the slurry.

The resin was supplied by SRTC in two forms. The first form, used in the oxygen transfer tests, was dry and not loaded with cesium. The second, a moist resin loaded with nonradioactive cesium, was used in the vitrification test. Based on drying in an oven at 100°C, it was approximately 38.4% solids. The ratio of cesium was 0.187 (g cesium)/(g oven-dried resin).

Oxygen Transfer Tests

Experimental Procedure

The oxygen transfer test was conducted using continuous slurry flow. The melter temperature was 1070°C. The oxygen sparge flow rate was 1 L/min. Slurry was fed at 50 mL/min. When the melter was operating at steady-state conditions, 300 g of resin was fed in 30 to 100 g portions to the melt to increase the $\text{Fe}^{2+}/\text{Fe}^{\text{Total}}$ ratio. The melter operation was continued with slurry feed containing the resin. During the run, samples of molten glass from the molten surface and from the exit glass were taken. These samples were analyzed to determine the $\text{Fe}^{2+}/\text{Fe}^{\text{Total}}$ ratio.

Glass Sampling Procedure

Glass was sampled both from the surface of the melt and from the exit glass stream during the testing. Outlet samples were taken by catching the glass stream on a stainless-steel plate. This glass was cooled in the air and then stored in labeled plastic vials. To obtain a sample from the melter, an Inconel™ welding rod was inserted approximately 4 cm beneath the surface of the melt, removed, and cooled in the air. The sample was removed from the rod by covering the glass with a paper towel and lightly tapping with a hammer.

Vitrification of Ion Exchange Resin

Experimental Procedure

The melter was filled to a depth of approximately 150 mm with glass having a nominal 8.6% by mass elemental iron content. The melter and auxiliary temperature controllers were adjusted to 1070°C and 1045°C, respectively. The oxygen sparger was turned on at a rate of 1.2 L/min. The packed tower scrubber and the jet bubbler tanks were filled with tap water. After the scrubber water circulated through the packed column for approximately thirty minutes, three scrubber solution sample blanks were taken. Three sample blanks were also taken from the jet bubbler tank. The feed bucket was filled at a ratio of 26.08 g of the moist resin loaded with nonradioactive cesium to 1 L of slurry. A small mixer kept the slurry and resin in suspension.

Samples were taken from this initial slurry mixture. When the melter reached the setpoint temperatures, slurry was added to the melter at a rate of 51 mL/min. During the run, the level in the feed bucket was maintained by adding the correct proportions of resin and slurry.

Sampling Procedure

Replicate samples of the initial batch and the final batch feed slurry were taken from the slurry feed nozzle. During the run, samples from the packed column and the jet bubbler tanks were taken hourly from the effluent pumped from the tank. Since the tank was mixed by bubbling, these samples should have been representative of the average concentration in the tank. Samples from effluent of the packed tower were taken from the flow pumped back into the reservoir. Samples of exit glass were taken approximately every thirty minutes.

After about 3 melter volumes of glass were produced, offgas sampling was conducted using a modified version of the EPA Method 29 sampling train.(6) Although this method has not been validated for cesium, it was felt that it should be accurate due to the high solubility of most common cesium compounds. Since mercury was not present in the feed, the two permanganate impingers for mercury were replaced with additional HNO₃/H₂O₂ impingers.

Analytical Methods.

Redox determination of all glass samples was performed using colorimetric analysis.(7) Glass and feed samples were chemically analyzed by Corning Laboratory Services, Corning, NY, using inductively coupled plasma emission spectroscopy (ICPES) and flame atomic absorption (AA) spectroscopy. Liquid samples were analyzed for cesium by SRTC using flame AA. The Method 29 samples were analyzed by Oxford Laboratories, Wilmington, NC.

RESULTS AND DISCUSSION

Oxygen Transfer Tests

The continuous feed test was performed to evaluate the oxygen transfer when slurry was fed to the melter. After 300 g of resin had been added, the melt was continuously fed slurry with

resin and allowed to reoxidize. Considering the total iron content of the glass in the melter and the redox ratio, the total moles of oxygen as Fe_2O_3 are shown in Fig. 2. The approximate oxygen transfer rate was 0.0096 (mol O_2)/min. Based on the crucible study,(4) this would accommodate a resin feed rate of 0.46 (g moist resin)/min.

Vitrification of Ion Exchange Resin

A mixture of nonradioactive cesium-laden resin and the slurry was fed to the melter for 23 hours with 3.1 tank volumes of glass produced. After approximately one hour, the $\text{Fe}^{2+}/\text{Fe}^{\text{Total}}$ ratio was nearly constant with an average value of 0.176. For HLW glass, this ratio is acceptable. At the end of the run, no corrosion or other damage to the impeller or melter tank was noted.

The samples taken at the beginning and at the end of the test were analyzed for major oxides and loss on ignition (LOI) at 850°C. The data, given in Table I, show that the cesium concentration of the feed slurry increased over the course of the run. The mass percent of Cs_2O in the dried slurry solids should have been approximately 0.464% by mass. The initial concentration was 0.26% by mass Cs_2O , which was lower than predicted. The final concentration was 0.55% by mass Cs_2O , which was higher than predicted. This could have been due to inadequate mixing in the feed bucket or a batching error.

To calculate the cesium fed to the melter, all cesium used in making the slurry batches minus the cesium remaining in the bucket after the test was estimated. The total moist resin used in making the feed was 2036 g. Since the resin was 38.4% oven-dried solids and loaded with cesium at a mass ratio of (0.187 g Cs)/(g oven-dried resin), the total cesium used in making the feed mixture was 146.20 g. Because 20.18 kg of feed was left in the bucket, some of this cesium was not fed to the melter. Since the cesium analyses of the slurry do not agree with that predicted based on the quantities of resin and slurry used in making the batch, the cesium remaining in the bucket after the test can be estimated using either the predicted mass percentage in the final slurry or the final measurement of the Cs_2O concentration. If the calculations are based on the predicted

Cs₂O in the feed mixture of 0.464% by mass and an LOI of 66.5%, the cesium remaining in the bucket was 29.59 g, and the cesium fed to the melter is estimated as 116.61 g. If the final value of 0.55% by mass Cs₂O is used, the cesium remaining in the bucket was 35.07 g resulting in an estimate of 111.13 g of cesium fed to the melter, or approximately 5% uncertainty.

Table II shows the analyses of glasses taken at four times during the run. The temporal changes in cesium concentration resemble those expected in a continuously stirred-tank reactor.

To calculate the total cesium retained in the glass, the average mass percentage of Cs₂O in the glass collected in the crucibles and the mass percentage of Cs₂O in the glass remaining in the vessel after the run was estimated. The sum of the cesium in the collected glass and in the glass remaining in the melter was the total cesium retained in the glass.

The average cesium oxide concentration in the glass produced, calculated by dividing the area under the curve by the total run time, was 0.218% by mass Cs₂O. Since the total glass collected was 25.87 kg, the mass was 56.40 g of Cs₂O or 53.20 g of elemental cesium.

The cesium in the glass remaining in the vessel was calculated by multiplying the final mass percentage of Cs₂O in the exit glass by the mass of glass remaining in the vessel. The last measured concentration of Cs₂O was 0.347% by mass. Since 8.85 kg glass remained in the vessel, the elemental cesium remaining was 28.97 g. The total amount of cesium in the glass was estimated to be 82.17 g. This is between 70.5% and 73.9% of the cesium fed to the melter.

Duct deposits were cleaned from the offgas piping exiting the melter and the riser. The deposits were dark brown to black in color and had the texture of fine soot. There were some very small yellow particles mixed in with the soot-like material. A total of 12.70 g of deposit was collected containing approximately 0.14 g of elemental cesium.

Four samples of the jet bubbler tank effluent were filtered and analyzed. The results of the analyses are shown in Table III. Neglecting the anomalously high point at 670 min, the elemental cesium in the exiting bubbler solution was 1.87 g. The final concentration of cesium in the jet bubbler tank was 2.23 (mg Cs)/L. Since the solution remaining in the tank was 91.8 L, the total

cesium remaining in the tank after the test was 0.205 g. The total elemental cesium captured in the bubbler was the sum or 2.07 g.

When the samples were taken from the effluent of the jet bubbler tank, there were small particles present in the solution. Since solids were present in the jet bubbler tank at the beginning of the run, recovered solids were not analyzed.

Four samples of the water from the packed tower were taken at the exit of the column. These samples had no detectable solids. The analyses are shown in Table III. The cesium concentration increased approximately linearly with time. The elemental cesium captured by the scrubber column estimated by multiplying the total volume of solution in the scrubber tank by its final concentration was 0.22 g.

Neglecting any cesium in particulate form filtered from the bubbler solution, the total emitted was the sum of cesium in offgas deposits, the filtered bubbler solution, and the packed column scrubber solution. This is 2.43 g, which only accounts for 2.1 to 2.2% of the total elemental cesium fed to the melter.

An alternative estimate of the cesium emissions is the sum of the cesium in the Method 29 emissions and in the offgas deposits. The estimated elemental cesium emissions were 0.206 g Cs per hour. If these emissions were constant over the 1385 minutes of the trial, the cesium emissions would have been 4.76 g. Adding in the cesium recovered in the offgas deposits, this gives an estimate of 4.90 g for the total cesium emissions. Even though this value is about twice the 2.43 g obtained in the first method, it only accounts for 4.1 to 4.3% of the cesium fed to the melter.

The percentage difference between the cesium fed to the melter and the sum of the cesium retained in the glass or emitted from the melter was 21.8 to 27.4%. There are several plausible reasons for this unaccounted cesium. First, cesium could have deposited on the walls of the melter's plenum, which were not sampled. Secondly, some errors in the feed, glass, offgas, or other chemical analyses may have occurred because of the small amount of cesium present.

CONCLUSIONS AND RECOMMENDATIONS

Both an oxygen transfer test and a test of the vitrification of cesium-laden resin were successfully conducted using a stirred melter. The oxygen transfer rate with a slurry feed rate of 50 mL/min, an oxygen sparging rate of 1 L/min, and impeller agitation was 0.0096 (mol O₂)/min.

The melter was successfully operated for 23 hours using a feed mixture of slurry and resin contaminated with nonradioactive cesium. There were no significant operational problems during the run. No damage to the Inconel melter or its impeller was noted after the run. At least 70.5 to 73.9% of the cesium fed to the melter was retained in the glass. Between 2.1 and 4.3% of the cesium was emitted. Since between 21.8 to 27.4% of the cesium was not recovered or accounted for, the overall cesium retention may have been much higher.

These promising results indicate that the ion exchange resin can be added along with HLW slurry feed in an oxygen-sparged, stirred tank melter.

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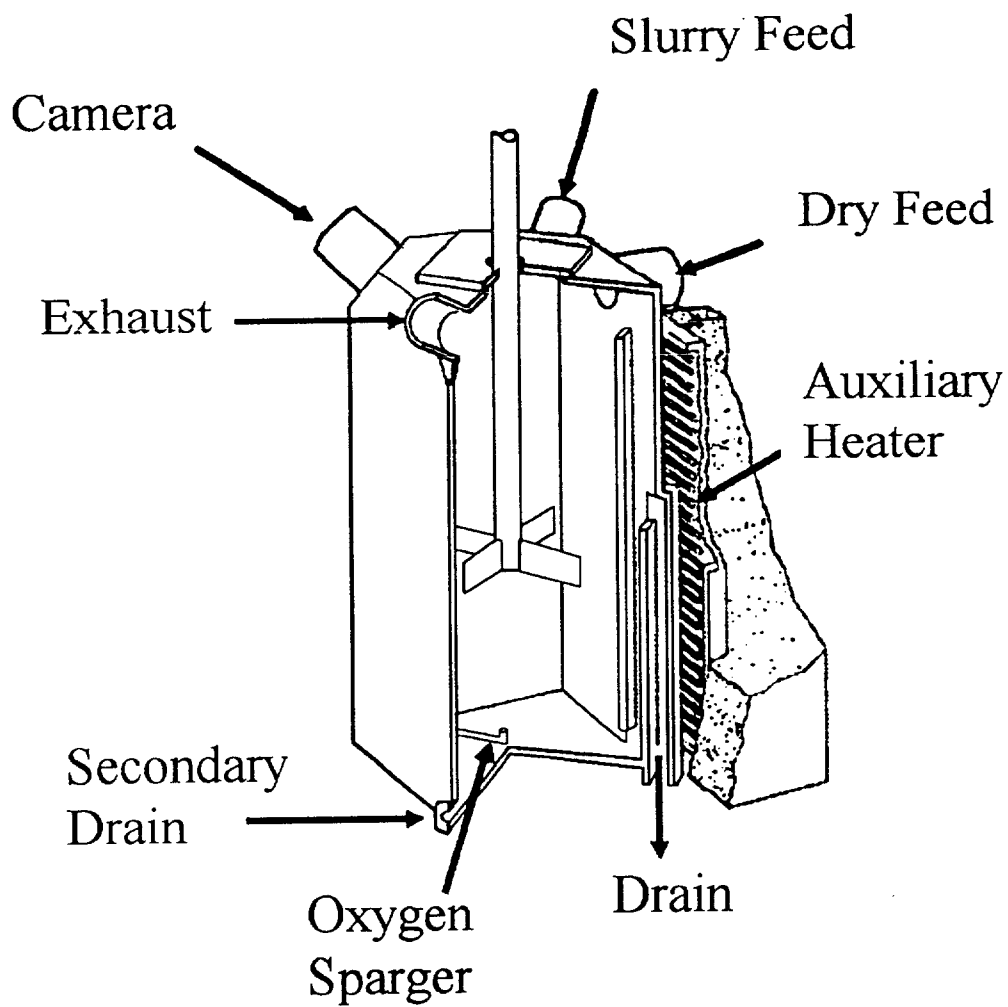


Fig. 1. Cutaway of Stir-Melter WV 0.25 with oxygen sparger.

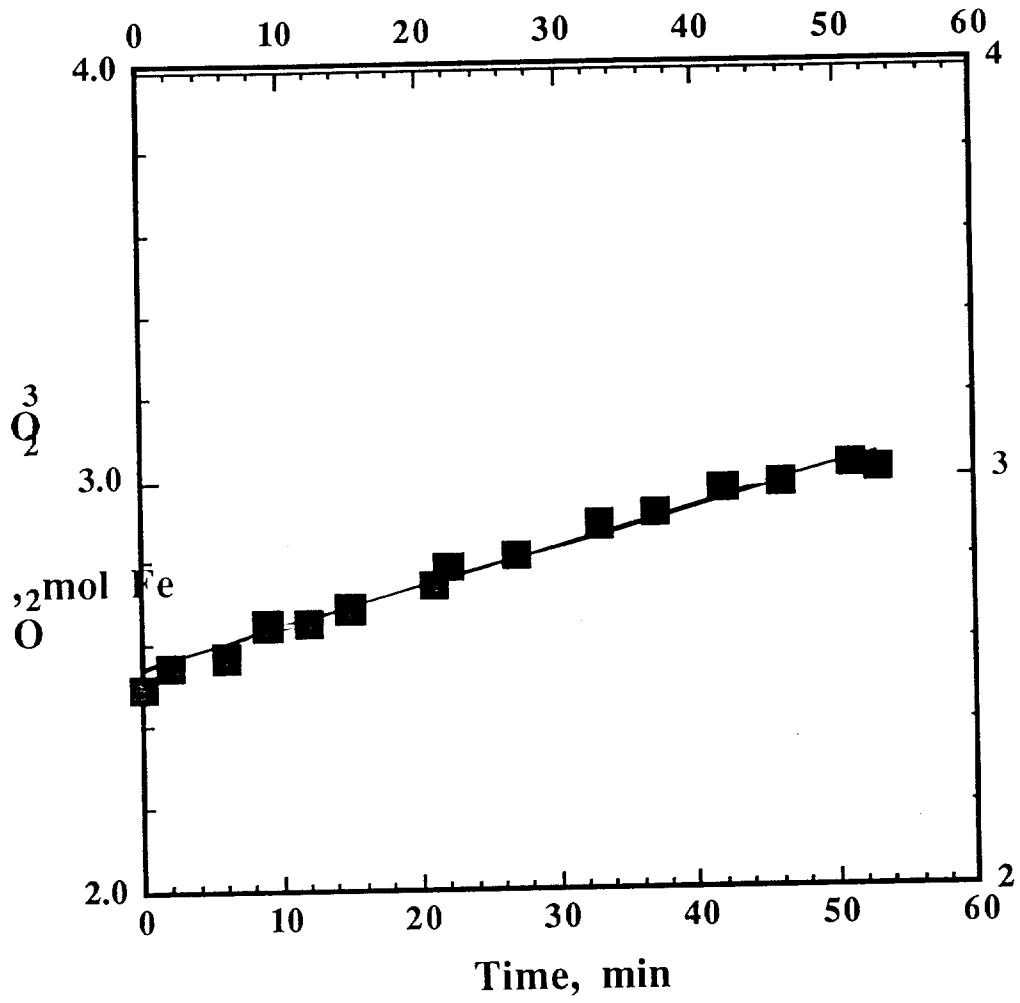


Fig. 2. Recovery curve for the continuous feed test.

TABLE I

Analysis of the Feed Slurry on an Oxide Basis.¹

Oxide	Initial Sample, Mass %	Final Sample, Mass %
CS ₂ O	0.26	0.55
K ₂ O	2.39	2.90
Li ₂ O	4.85	4.50
Na ₂ O	6.46	6.54
Al ₂ O ₃	2.95	3.35
B ₂ O ₃	7.77	7.60
CaO	1.02	1.26
Cr ₂ O ₃	0.13	0.16
Fe ₂ O ₃	12.05	14.20
MgO	1.55	1.48
MnO	2.15	2.55
NiO	1.11	1.30
SiO ₂	<u>54.35</u>	<u>50.75</u>
Total	97.04	97.14
Loss on Ignition, %	63.00	66.50

¹Average of two samples.

TABLE II

Analysis of Exit Glass on an Oxide Basis

Oxide	0 min	627 min	920 min	1385 min
Cs ₂ O	< 0.01	0.24	0.30	0.35
K ₂ O	2.43	2.70	2.76	2.76
Li ₂ O	4.75	4.79	4.82	4.80
Na ₂ O	6.69	6.69	6.73	6.76
Al ₂ O ₃	3.09	3.05	3.04	3.07
B ₂ O ₃	7.90	7.75	7.76	7.80
CaO	1.70	1.24	1.23	1.24
Cr ₂ O ₃	0.19	0.17	0.17	0.17
Fe ₂ O ₃	12.00	12.25	12.50	12.57
MgO	1.56	1.53	1.56	1.56
MnO	2.15	2.24	2.28	2.28
NiO	1.15	1.18	1.20	1.21
SiO ₂	<u>54.10</u>	<u>52.70</u>	<u>53.55</u>	<u>53.67</u>
Total	97.72	96.53	97.80	98.24

The values are averages of three samples taken at 0 and 1385 minutes and of replicate analyses on one sample taken at 627 and 920 minutes.

TABLE III

Bubbler and Scrubber Cesium Concentrations

Time, min	Bubbler Solution, (mg Cs)/L	Scrubber Solution, (mg Cs)/L
0	0.0046	ND ¹
670	2.6942	0.2271
1075	2.1131	0.4518
1281	2.1617	0.5491
1385	2.2278	0.6615

¹Not detected.

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Connie A. Cicero-Herman *9/23/97*
Author's Signature Date

Approvals by Author's Organization	
Derivative Classifier	Distribution <input checked="" type="checkbox"/> Unlimited <input type="checkbox"/> Limited (Explain below)
Classification	Topic

Explanations

Manager's Name <i>CR Gootzman</i>	Manager's Signature <i>CR Gootzman</i>	Date <i>12/4/97</i>
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Classification Information (To be completed by Classification Reviewer)	
Classification (Check one for each) Overall <input type="checkbox"/> S <input type="checkbox"/> C <input type="checkbox"/> UCNI <input checked="" type="checkbox"/> U Abstract <input type="checkbox"/> S <input type="checkbox"/> C <input type="checkbox"/> UCNI <input checked="" type="checkbox"/> U Title <input type="checkbox"/> S <input type="checkbox"/> C <input type="checkbox"/> UCNI <input checked="" type="checkbox"/> U Cover Letter <input type="checkbox"/> S <input type="checkbox"/> C <input type="checkbox"/> UCNI <input type="checkbox"/> U	Classification Guide Topics <i>No Export Control concerns</i> R. L. SHANKLE CLASSIFICATION ANALYST <i>R L Shankle</i> <i>12/10/97</i>

WSRC Classification Officer's Name R. L. SHANKLE CLASSIFICATION ANALYST	WSRC Classification Officer's Signature <i>R L Shankle</i>	Date <i>12/10/97</i>
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Publications Use Only	
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Publications Manager	Editor



Westinghouse
Savannah River Company

P.O. Box 616
Aiken, SC 29802

December 10, 1997

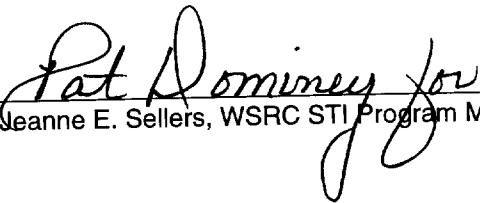
WSRC-MS-97-0565
MSD-STI-97-1355

Ms. W. F. Perrin, Technical Information Officer
U. S. Department of Energy - Savannah River Operations Office

Dear Ms. Perrin:

REQUEST FOR APPROVAL TO RELEASE SCIENTIFIC/TECHNICAL INFORMATION

The attached document is submitted for classification and technical approvals for the purpose of external release. Please complete Part II of this letter and return the letter to the undersigned by 1/23/98. The document has been reviewed for classification and export control by a WSRC Classification staff member and has been determined to be Unclassified.


Jeanne E. Sellers, WSRC STI Program Manager

I. DETAILS OF REQUEST FOR RELEASE

Document Number: WSRC-MS-97-0565
Author's Name: C. A Cicero-Herman
Location: 773-41A Phone 5-5306
Department: SRTC
Document Title: Vitrification of Cesium-Laden Organic Ion Exchange Resin in a Stirred Melter

Presentation/Publication:
Meeting/Journal: Nuclear Technology Journal

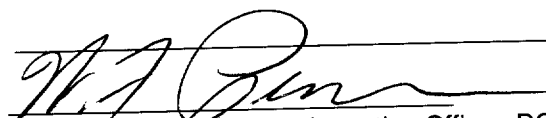
Location:
Meeting Date:

II. DOE-SR ACTION

Date Received by TIO 12/10/97

- Approved for Release
- Approved Upon Completion of Changes
- Approved with Remarks
- Not Approved
- Revise and Resubmit to DOE-SR

Remarks: _____


W. F. Perrin, Technical Information Officer, DOE-SR

1/5/98
Date



MSD-STI-97-1355

December 10, 1997

Mr. Murray Baxter
WSRC Intellectual Property Rights Office
Building 730-B
Savannah River Site
Aiken, SC 29808

Dear Mr. Baxter:

REQUEST FOR APPROVAL TO RELEASE SCIENTIFIC/TECHNICAL INFORMATION (U)

Please review the enclosed document for patent considerations. Please be advised that this document will be released within two weeks of the above date. Please complete the reponse section of this letter and return to the undersigned. Technical questions pertaining to the contents of this document should be addressed to the author or the manager. Questions concerning the processing of this document should be addressed to the WSRC STI Program office at (803) 725-4432.

Pat Romney Jor

Jeanne Sellers,
Manager
WSRC STI Program

Document No.	<u>WSRC-MS-97-0565</u>
Document Title	<u>Vitrification of Cesium-Laden Organic Ion Exchange Resin in a Stirred Melter</u>
Author	<u>C. A Cicero-Herman</u>
WSRC response due by	<u>January 23, 1998</u>
Patent Related?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes
WSRC Remarks	<u>In telephone conversation (29DEC97) with C.A. Cicero-Herman, she informed me that no invention was involved. All apparatus/methods are known in the art.</u>
<u>Murray N Baxter</u> Murray Baxter, WSRC Intellectual Property Rights Attorney	<u>29 DEC 97</u> Date

U.S. DEPARTMENT OF ENERGY
ANNOUNCEMENT AND DISTRIBUTION OF DEPARTMENT OF ENERGY (DOE)
SCIENTIFIC AND TECHNICAL INFORMATION (STI)
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PART I Information Product Identification

A. Identifiers

1. Product/Report Nos.

____ WSRC-MS-97-0565

2. Award/Contract Nos.

____ DE-AC09-96SR18500

3. Title

____ Vitrification of Cesium-Laden Organic Ion Exchange Resin in a Stirred Melter

(Grantees and Awardees skip to Part 1.B.)

4. Funding Office(s)

____ DOE-SR

5. B&R Code(s)

6. Project ID(s)

7. CRADA Nos.

8. UC/C Category(ies)

9. Information Product Filename

____ UC-721

B. Information Product Description

____ 1. Report

a. Type ____ Quarterly ____ Semiannual ____ Annual ____ Final ____ Topical

____ Other (Specify) _____

b. Dates covered (mm/dd/yyyy) ____ / ____ / ____ thru ____ / ____ / ____

____ 2. Conference

a. Type ____ Conference paper ____ Published proceedings Other (Specify) _____

Journal

b. Conference title (No abbreviations) ____ Nuclear Technology Journal

c. Conference location (city/state/country) _____

d. Conference dates (mm/dd/yyyy) _____ thru _____

e. Conference sponsor(s) ____ American Nuclear Society

____ 3. Software (Note: Additional forms are required. Follow instructions provided with this form.)

____ 4. Other (Provide complete description.) _____

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(b) Machine compatibility (Specify) _____

(c) Operating system (Specify) _____

(d) File format ___ SGML ___ HTML ___ Postscript ___ PDF ___ TIFFG4 ___ Other (Specify) _____

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(a) Quantity/type (Specify) _____

(b) Machine compatibility (Specify) _____

(c) Sound ___ Yes ___ No (d) Color ___ Yes ___ No (e) Playing time _____

(4) **Paper**

___ 3. Additional Instructions/explanations _____

D. Contact (Person knowledgeable about the information product and its submission)

Name Jeanne E. Sellers Position Manager, STI Phone (803) 725-2321

Organization Westinghouse Savannah River Company E-Mail jeanne.sellers@srs.gov

A. Recommendations (Mark at least one)

1. Unlimited Announcement (Available to U.S. and non-U.S. public)

2. Unlimited Announcement/U.S. Dissemination Only

3. Classified (Standard announcement)

4. OpenNet

a. Non-NTIS Availability (Required if not available from NTIS)

(1) Accession Number _____ (2) Document Location _____

b. Field Office Acronym SR

c. Declassification date (mm/dd/yyyy) ___/___/___ Sanitized Never classified

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c. Export Control/ITAR/EAR

d. Temporary hold pending patent review

e. Translation of copyrighted material

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g. Small Business Technology Transfer (STTR) Release date (mm/dd/yyyy) ___/___/___

h. Proprietary

i. Protected CRADA information Release date (mm/dd/yyyy) ___/___/___

j. Official Use Only (OUO)

k. Program-Directed Special Handling (Specify) _____

l. Other (Specify) _____

B. Releasing Official

1. Patent Clearance (Mark one)

a. Submitted for DOE patent clearance Date submitted (mm/dd/yyyy) 12/10/97

b. DOE patent clearance has been granted

c. DOE patent clearance not required

2. Released by Name Murray Baxter, WSRC Intellectual Property Date (mmdd/yyyy) _____
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A. Personal Author/Affiliation C. A. Cicero-Herman ; Westinghouse Savannah River Company

B. Performing Organization Westinghouse Savannah River SC US

C. Date of Publication (mm/dd/yyyy) 7/9/97 **D. Pages/Size** 20

E. Abstract

The goal of this research was a feasibility study for vitrifying the organic ion exchange resin in a stirred-tank melter. Tests were conducted to determine the fate of cesium including the feed, exit glass, and offgas streams and to assess any impact of feeding the resin on the melter or its performance.

F. Subject Terms Vitrification, Ion Exchange Resins, Cesium

G. OpenNet Document Type Audiovisual Material Book Conference Correspondance Data Dissertation/Thesis

H. OpenNet Document Categories

I. OpenNet Addressee
