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ORNL/TM-2006/508

Data Compilation for AGR-1 Variant 1 Compact Lot LEU01-47T-Z

Revision 0

John D. Hunn, Fred C. Montgomery and Peter J. Pappano

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Data Compilation for AGR-1 Variant 1 Compact Lot LEU01-47T-Z

J. D. Hunn, F. C. Montgomery and P. J. Pappano
Oak Ridge National Laboratory

This document is a compilation of characterization data for the AGR-1 variant 1 compact lot LEU01-47T-Z. The compacts were produced by ORNL for the Advanced Gas Reactor Fuel Development and Qualification (AGR) program for the first AGR irradiation test train (AGR-1). This compact lot was fabricated using particle composite LEU01-47T, which was a composite of three batches of TRISO-coated 350 μm diameter 19.7% low enrichment uranium oxide/uranium carbide kernels (LEUCO). The AGR-1 TRISO-coated particles consist of a spherical kernel coated with an ~50% dense carbon buffer layer (100 μm nominal thickness), followed by a dense inner pyrocarbon layer (40 μm nominal thickness), followed by a SiC layer (35 μm nominal thickness), followed by another dense outer pyrocarbon layer (40 μm nominal thickness). The kernels were obtained from BWXT and identified as composite G73D-20-69302. The BWXT kernel lot G73D-20-69302 was riffled into sublots for characterization and coating by ORNL and identified as LEU01-## (where ## is a series of integers beginning with 01). A data compilation for the AGR-1 variant 1 coated particle composite LEU01-47T can be found in ORNL/TM-2006/020.

The AGR-1 Fuel Product Specification and Characterization Guidance (INL EDF-4380) provides the requirements necessary for acceptance of the fuel manufactured for the AGR-1 irradiation test. Section 6.2 of EDF-4380 provides the property requirements for the heat treated compacts. The Statistical Sampling Plan for AGR Fuel Materials (INL EDF-4542) provides additional guidance regarding statistical methods for product acceptance and recommended sample sizes. The procedures for characterizing and qualifying the compacts are outlined in ORNL product inspection plan AGR-CHAR-PIP-05. The inspection report forms generated by this product inspection plan document the product acceptance for the property requirements listed in section 6.2 of EDF-4380.

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1 Summary of acceptance test results for LEU01-47T-Z

This section contains inspection report forms (IRFs) associated with the compact lot LEU01-47T-Z. These inspection report forms also appear in a later section of this compilation, accompanied by the associated data report forms (DRFs) showing the results of each individual measurement. These inspection report forms summarize the acceptance testing performed according to the product inspection plan AGR-CHAR-PIP-05. The information in these forms covers all the property specifications listed in section 6.2 of the AGR-1 Fuel Product Specification and Characterization Guidance document INL EDF-4380, Rev. 8. The compact lot, LEU01-47T-Z, was found to meet all the requirements in section 6.2 of EDF-4380, Rev. 8.

Table 1-1 is provided for quick reference. It gives the mean values of key variable properties of the compact lot, LEU01-47T-Z. For standard deviations of the distribution of the measured values see the appropriate IRF or DRF. For discussions on the uncertainty in these values, see the associated data acquisition methods and data report forms.

Table 1-1: Quick reference table for key variable properties of LEU01-47T-Z.

Property	Mean
Mean uranium loading (g U/compact)	0.915
Compact diameter (mm)	12.36
Compact length (mm)	25.12
Compact mass (g)	5.34
Impurity content	Table 1-2

The mean impurity levels for the fuel compacts reported on IRF-05A and IRF-05B are probably higher than the actual values for two reasons. First, the as-reported mean impurity levels do not reflect the fact that some of the measurements were at or below the measurement threshold and could not be differentiated from zero. Second, the as-reported mean impurity levels do not account for impurities introduced during the analysis.

Each time a leach was performed, a blank run was also performed where all the relevant wet chemistry steps in the leach-burn-leach procedure in AGR-CHAR-DAM-26R0 were performed without a compact present in order to obtain background values for the analyzed impurities. Table 1-2 shows the total as-reported mean and standard deviation for each measured impurity as well as the total mean values adjusted by subtracting the background values obtained from the associated blank runs. In cases where the value for the blank run was reported as being below a certain measurement threshold value, a minimum value for that leach was calculated by subtracting the threshold value and a maximum value was calculated by subtracting zero. The adjusted mean therefore accounts for all the measurable impurities in the blanks and spans a range that reflects the uncertainty due to the measurement thresholds.

Table 1-2: Mean impurity levels for fuel compacts from LEU-47T-Z compact lot measured by deconsolidation leach-burn-leach technique.

Measured Impurity	As-reported Mean	Adjusted Mean	
		Mininum	Maximum
Fe outside SiC (µg/compact):	2.54 ± 0.54	0.97 ± 0.59	0.97 ± 0.59
Cr outside SiC (µg/compact):	1.62 ± 0.02	0.00 ± 0.00	1.62 ± 0.02
Mn outside SiC (µg/compact):	0.25 ± 0.04	0.02 ± 0.04	0.25 ± 0.04
Co outside SiC (µg/compact):	0.648 ± 0.007	0.00 ± 0.00	0.648 ± 0.007
Ni outside SiC (µg/compact):	1.22 ± 0.02	0.04 ± 0.05	1.03 ± 0.23
Cr+Mn+Co+Ni outside SiC (µg/compact):	3.75 ± 0.04	0.06 ± 0.08	3.55 ± 0.24
Ca outside SiC (µg/compact):	21.65 ± 3.07	5.86 ± 3.04	5.86 ± 3.04
Al outside SiC (µg/compact):	10.70 ± 2.60	3.01 ± 1.21	8.21 ± 0.81
Ti outside SiC (µg/compact):	11.16 ± 0.37	9.12 ± 0.34	11.16 ± 0.37
V outside SiC (µg/compact):	19.72 ± 0.81	18.78 ± 0.82	19.72 ± 0.81
Ti + V outside SiC (µg/compact):	30.87 ± 0.72	27.90 ± 0.75	30.87 ± 0.72

Table 1-3 is also provided for quick reference. It gives the upper limit of the 95% confidence interval of the defect fraction for key attribute properties of the compact lot LEU01-47T-Z. In other words, these values are the lowest tolerance limits for which the compact lot would be deemed acceptable at 95% confidence based on the particular sample that was measured. For the actual number of trials and number of failures observed, see the inspection report form for the compact lot.

Table 1-3: Quick reference table for key attribute properties of LEU01-47T-Z.

Property	Defect Fraction
Uranium contamination fraction	$\leq 4.1 \cdot 10^{-5}$
Defective SiC coating fraction	$\leq 6.1 \cdot 10^{-5}$
Defective IPyC coating fraction	$\leq 6.1 \cdot 10^{-5}$
Defective OPyC coating fraction	$\leq 1.8 \cdot 10^{-3}$

Also worthy of note is the observation of particles with SiC layers less than 20 μm thick. These were observed and noted for information only during x-ray analysis for uranium dispersion after compacting due to defective IPyC. In terms of the upper limit of the 95% confidence interval of the anomaly fraction, as reported in Table 1-3, the fraction of particles in the compact lot with SiC <20 μm thick is $\leq 7.8 \cdot 10^{-4}$. This anomaly is probably caused by particles being temporarily trapped in carbon soot that has built up on the walls of the coating chamber above the fluidized particle bed. This is the same mechanism thought to cause soot inclusions (goldspots) within the SiC layer.

DRF-24 indicates that all compacts met the dimensional specifications in EDF-4380, Rev. 8. Table 1-4 lists the compacts that are available for irradiation sorted in order of increasing length.

Table 1-4: Compacts from LEU-47T-Z compact lot available for irradiation sorted by length

Compact ID Number	Length (mm)	Diameter (mm)						Pass Thru? (Y or N)	Mass (g)	Accept? (pass or fail)
		Top 1	Top 2	Middle 1	Middle 2	Bottom 1	Bottom 2			
12	25.031	12.36	12.37	12.37	12.37	12.35	12.36	Y	5.3288	pass
70	25.036	12.37	12.37	12.37	12.36	12.35	12.36	Y	5.3219	pass
63	25.059	12.37	12.36	12.37	12.37	12.35	12.35	Y	5.3222	pass
24	25.063	12.36	12.37	12.37	12.37	12.35	12.36	Y	5.3006	pass
56	25.079	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3358	pass
23	25.081	12.36	12.36	12.36	12.36	12.35	12.36	Y	5.3197	pass
64	25.087	12.36	12.36	12.37	12.37	12.35	12.35	Y	5.3395	pass
36	25.088	12.37	12.37	12.37	12.37	12.36	12.36	Y	5.3584	pass
06	25.092	12.36	12.36	12.37	12.37	12.36	12.36	Y	5.3316	pass
25	25.099	12.37	12.36	12.37	12.37	12.35	12.36	Y	5.3321	pass
28	25.099	12.37	12.37	12.37	12.37	12.35	12.35	Y	5.3477	pass
62	25.100	12.36	12.36	12.36	12.36	12.34	12.35	Y	5.3370	pass
52	25.101	12.35	12.36	12.37	12.37	12.35	12.35	Y	5.3324	pass
33	25.102	12.37	12.36	12.37	12.37	12.35	12.36	Y	5.3354	pass
79	25.104	12.36	12.36	12.37	12.36	12.36	12.36	Y	5.3459	pass
60	25.110	12.37	12.37	12.36	12.37	12.35	12.36	Y	5.3445	pass
38	25.111	12.37	12.37	12.37	12.37	12.36	12.36	Y	5.3382	pass
17	25.114	12.36	12.37	12.37	12.37	12.36	12.36	Y	5.3495	pass
74	25.114	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3263	pass
10	25.116	12.37	12.36	12.37	12.37	12.35	12.35	Y	5.3327	pass
11	25.117	12.37	12.37	12.37	12.37	12.35	12.36	Y	5.3128	pass
59	25.119	12.36	12.36	12.37	12.37	12.35	12.35	Y	5.3660	pass
19	25.120	12.37	12.37	12.36	12.36	12.35	12.35	Y	5.3470	pass
18	25.121	12.37	12.36	12.37	12.37	12.36	12.36	Y	5.3225	pass
71	25.121	12.36	12.36	12.36	12.35	12.35	12.35	Y	5.3345	pass
07	25.123	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3343	pass
47	25.123	12.36	12.36	12.37	12.37	12.36	12.35	Y	5.3576	pass
66	25.124	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3350	pass
68	25.126	12.37	12.37	12.36	12.37	12.35	12.34	Y	5.3470	pass
13	25.128	12.36	12.36	12.36	12.36	12.36	12.36	Y	5.3247	pass
55	25.132	12.36	12.35	12.36	12.36	12.35	12.35	Y	5.3494	pass
69	25.132	12.36	12.36	12.36	12.37	12.35	12.35	Y	5.3479	pass
32	25.133	12.36	12.36	12.37	12.36	12.35	12.36	Y	5.3471	pass
42	25.134	12.36	12.37	12.37	12.37	12.35	12.35	Y	5.3515	pass
53	25.134	12.36	12.36	12.36	12.37	12.35	12.35	Y	5.3418	pass
72	25.138	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3267	pass
51	25.139	12.36	12.36	12.36	12.37	12.35	12.35	Y	5.3372	pass
57	25.139	12.36	12.36	12.37	12.37	12.35	12.35	Y	5.3739	pass
30	25.141	12.37	12.37	12.37	12.37	12.35	12.35	Y	5.3533	pass
20	25.143	12.36	12.37	12.36	12.37	12.36	12.36	Y	5.3532	pass
67	25.146	12.36	12.37	12.36	12.36	12.35	12.35	Y	5.3457	pass
77	25.147	12.37	12.36	12.37	12.37	12.36	12.36	Y	5.3378	pass
08	25.148	12.37	12.36	12.36	12.36	12.36	12.36	Y	5.3325	pass
35	25.156	12.36	12.36	12.37	12.36	12.35	12.35	Y	5.3490	pass
65	25.156	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3344	pass
49	25.157	12.36	12.36	12.36	12.36	12.35	12.34	Y	5.3438	pass
04	25.173	12.36	12.37	12.37	12.36	12.35	12.36	Y	5.3408	pass
21	25.208	12.37	12.37	12.37	12.37	12.35	12.36	Y	5.3420	pass

Inspection Report Form IRF-05A: Fuel Compact Lots

Procedure:	AGR-CHAR-PIP-05 Rev. 0
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID numbers of compacts available for irradiation test (pending acceptance):	04,06,07,08,10,11,12,13,17,18,19,20,21,23,24,25,28,30,32,33,35,36,38,42 47,49,51,52,53,55,56,57,59,60,62,63,64,65,66,67,68,69,70,71,72,74,77,79

Property	Measured Data				Specification	Acceptance Criteria	Acceptance Test Value	Pass or fail	Data Records
	Mean (x)	Std. Dev. (s)	Measurements (n)	k or t value	INL EDF-4380 Rev. 8				
Compact diameter (mm)	See DRF-24				12.22 - 12.46	all available for irradiation test meet specification		Pass	DRF-24
Compact length (mm)					25.02 - 25.40				
Uranium loading (gU/compact)	0.915	0.004	6	2.015	0.905 ± 0.04	A = x - ts/√n ≥ 0.865	0.912	pass	DRF-25
						B = x + ts/√n ≤ 0.945	0.918	pass	
Iron content outside SiC (µg/compact)	2.54	0.54	4	2.353	mean ≤ 25	B = x + ts/√n ≤ 25	3.2	pass	IRF-05B DRF-26
				7.042	dispersion ≤0.01 ≥ 100	D = x + √3ks < 100	9.1	pass	
Chromium content outside SiC (µg/compact)	1.62	0.02	4	2.353	mean ≤ 75	B = x + ts/√n ≤ 75	1.6	pass	IRF-05B DRF-26
Manganese content outside SiC (µg/compact)	0.25	0.04	4	2.353	mean ≤ 75	B = x + ts/√n ≤ 75	0.3	pass	IRF-05B DRF-26
Cobalt content outside SiC (µg/compact)	0.65	0.01	4	2.353	mean ≤ 75	B = x + ts/√n ≤ 75	0.7	pass	IRF-05B DRF-26
Nickel content outside SiC (µg/compact)	1.22	0.02	4	2.353	mean ≤ 75	B = x + ts/√n ≤ 75	1.2	pass	IRF-05B DRF-26
Cr + Mn + Co + Ni content outside SiC (µg/compact)	3.75	0.04	4	7.042	dispersion ≤0.01 ≥ 300	D = x + √3ks < 300	4.2	pass	IRF-05B DRF-26
Calcium content outside SiC (µg/compact)	21.65	3.07	4	2.353	mean ≤ 90	B = x + ts/√n ≤ 90	25.3	pass	IRF-05B DRF-26
Aluminum content outside SiC (µg/compact)	10.70	2.60	4	2.353	mean ≤ 45	B = x + ts/√n ≤ 45	13.8	pass	IRF-05B DRF-26
Ti + V content outside SiC (µg/compact)	30.87	0.72	4	2.353	mean ≤ 400	B = x + ts/√n ≤ 400	31.7	pass	IRF-05B DRF-26

Property	Measured Data		Specification	Acceptance Criteria	Acceptance Test Value	Pass or fail	Data Records
	# of compacts	# of particles	INL EDF-4380				
Uranium contamination fraction (g exposed U/gram U in compact)	18	74699	≤ 1.0 x 10^{-4}	≤4 effectively exposed kernels in ≥91533 particles or ≤2 effectively exposed kernels in ≥62956 particles	0	pass	IRF-05C DRF-26
Defective SiC coating fraction (fraction of total particles)	12	49799	≤ 2.0 x 10^{-4}	≤4 leached kernels in ≥45766 particles or ≤12 leached kernels in ≥97210 particles	0	pass	IRF-05D DRF-26
Defective IPyC coating fraction (fraction of total particles)	12	49799	≤ 2.0 x 10^{-4}	≤4 with excessive U dispersion in ≥45766 particles or ≤12 with excessive U dispersion in ≥97210 particles	0	pass	DRF-28
Defective OPyC coating fraction (fraction of total particles)	2	8300	≤ 0.01	≤6 cracked or missing OPyC in ≥1182 particles or ≤30 cracked or missing OPyC in ≥4064 particles	8	pass	DRF-27

Comments

Note 1: Per EDF-4380, a specification on Cl content outside SiC is not applicable because HCl cleaning of compacts was not performed.
Note 2: Only 18 compacts were available for determination of U contamination fraction. ≤2 defects in ≥62956 particles shows ≤1E-4 defect fraction to 95% confidence.

[signature] 7-19-06

QC Supervisor **Date**

Accept compact lot (Yes or No):	Yes

[signature] 7/20/06

QA Reviewer **Date**

Inspection Report Form IRF-05B: Summary of Impurites Outside SiC

Procedure:	AGR-CHAR-PIP-05 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact Lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T

Compact ID numbers:	05, 34, 46	31, 37, 54	02, 27, 40	26, 41, 48	Mean	Standard Deviation
Number of compacts:	3	3	3	3		
Iron						
Deconsolidation-leach (DRF-26A) (µg):	5.64	3.39	4.48	4.03		
Burn-leach (DRF-26B) (µg):	3.91	2.21	2.86	3.92		
Total leached (µg):	9.55	5.60	7.34	7.95		
Fe outside SiC (µg/compact):	**3.18**	**1.87**	**2.45**	**2.65**	**2.54**	**0.54**
Chromium						
Deconsolidation-leach (DRF-26A) (µg):	3.43	3.43	3.54	3.43		
Burn-leach (DRF-26B) (µg):	1.41	1.41	1.41	1.41		
Total leached (µg):	4.84	4.84	4.95	4.84		
Cr outside SiC (µg/compact):	**1.61**	**1.61**	**1.65**	**1.61**	**1.62**	**0.02**
Manganese						
Deconsolidation-leach (DRF-26A) (µg):	0.73	0.49	0.50	0.49		
Burn-leach (DRF-26B) (µg):	0.20	0.20	0.20	0.20		
Total leached (µg):	0.93	0.69	0.71	0.69		
Mn outside SiC (µg/compact):	**0.31**	**0.23**	**0.24**	**0.23**	**0.25**	**0.04**
Cobalt						
Deconsolidation-leach (DRF-26A) (µg):	1.37	1.37	1.41	1.37		
Burn-leach (DRF-26B) (µg):	0.56	0.56	0.56	0.56		
Total leached (µg):	1.93	1.93	1.97	1.93		
Co outside SiC (µg/compact):	**0.64**	**0.64**	**0.66**	**0.64**	**0.65**	**0.01**
Nickel						
Deconsolidation-leach (DRF-26A) (µg):	2.43	2.44	2.52	2.45		
Burn-leach (DRF-26B) (µg):	1.23	1.30	1.15	1.17		
Total leached (µg):	3.66	3.74	3.67	3.62		
Ni outside SiC (µg/compact):	**1.22**	**1.25**	**1.22**	**1.21**	**1.22**	**0.02**
Transition Metals						
Cr+Mn+Co+Ni outside SiC (µg/compact):	**3.79**	**3.74**	**3.77**	**3.70**	**3.75**	**0.04**
Calcium						
Deconsolidation-leach (DRF-26A) (µg):	53.30	48.00	32.90	30.30		
Burn-leach (DRF-26B) (µg):	23.21	20.18	24.90	26.97		
Total leached (µg):	76.51	68.18	57.80	57.27		
Ca outside SiC (µg/compact):	**25.50**	**22.73**	**19.27**	**19.09**	**21.65**	**3.07**
Aluminum						
Deconsolidation-leach (DRF-26A) (µg):	17.79	14.97	26.60	30.60		
Burn-leach (DRF-26B) (µg):	8.60	9.84	9.44	10.51		
Total leached (µg):	26.39	24.81	36.04	41.11		
Al outside SiC (µg/compact):	**8.80**	**8.27**	**12.01**	**13.70**	**10.70**	**2.60**
Titanium						
Deconsolidation-leach (DRF-26A) (µg):	10.47	12.42	14.88	13.36		
Burn-leach (DRF-26B) (µg):	22.94	20.07	20.14	19.62		
Total leached (µg):	33.41	32.49	35.02	32.98		
Ti outside SiC (µg/compact):	**11.14**	**10.83**	**11.67**	**10.99**	**11.16**	**0.37**
Vanadium						
Deconsolidation-leach (DRF-26A) (µg):	30.54	29.05	28.43	28.84		
Burn-leach (DRF-26B) (µg):	28.09	33.59	29.85	28.19		
Total leached (µg):	58.63	62.64	58.28	57.03		
V outside SiC (µg/compact):	**19.54**	**20.88**	**19.43**	**19.01**	**19.72**	**0.81**
Titanium and Vanadium						
Ti + V outside SiC (µg/compact):	**30.68**	**31.71**	**31.10**	**30.00**	**30.87**	**0.72**

QC Supervisor

5-16-06

Date

Inspection Report Form IRF-05C: Summary of Uranium Contamination

Procedure:	AGR-CHAR-PIP-05 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact Lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T

Compact ID numbers:	05, 34, 46	31, 37, 54	02, 27, 40	26, 41, 48		03, 16, 22, 58, 61, 73	Total
Number of compacts:	3	3	3	3		6	18
Effective number of exposed kernels:	0.0	0.0	0.0	0.0		0.0	0.0

QC Supervisor

5-16-06
Date

Inspection Report Form IRF-05D: Summary of SiC Burn-Leach Defects

Procedure:	AGR-CHAR-PIP-05 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact Lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T

Compact ID numbers:	05, 34, 46	31, 37, 54	02, 27, 40	26, 41, 48			Total
Number of compacts:	3	3	3	3			12
Number of leached kernels:	0	0	0	0			0

QC Supervisor

5-16-06
Date

2 Compacting process conditions

LEU01-47T TRISO (variant 1) particles were received from the characterization group after removing particles for characterization according to AGR-CHAR-PIP-04R2, "Product Inspection Plan for Coated Particle Composites." Sixteen ~20 g aliquots were prepared via riffling, and one aliquot was used per overcoating run. Prior to overcoating, the particles were washed in methanol per procedure AGR-TRISOWASH-SOP-1, "Standard Operating Procedure for TRISO Particle Washing." Washing of particles prior to overcoating was adapted in order to help reduce the amount of contamination on the particles that may have been acquired during processing or general handling. The washing procedure was adopted from General Atomics' particle washing procedures.

After washing, the LEU01-47T particles were overcoated using matrix batch GKrS 030306. All of the aliquots were overcoated producing 444 g of +18 particles. "+18" particles are those that pass through an ASTM E11 No. 16 sieve (1.18 mm) but do not pass through and ASTM E11 No. 18 sieve (1.00 mm). Producing this weight of +18 overcoated variant 1 particles in 16 runs represents an increase in efficiency from baseline to variant 1 overcoating of ~27%, as only 349g of +18 baseline particles were produced after 16 overcoating runs. Because of this increase in efficiency, no re-overcoating nor rinsing of overcoated particles with methanol (in order to recover TRISO particles and overcoat them) was needed.

The 444 g of +18 particles was then tabled and 424 g of +18 Bin 3 particles were recovered. "Bin 3" particles are those particles that end up in the third bin of the tabler; these are the most spherical of the +18 particles. 424 g of +18 Bin 3 overcoated particles was determined to be a sufficient quantity to produce at least 79 compacts, based on preliminary calculations.

Based on an average kernel weight of $2.42 \cdot 10^{-4}$ g and a wt% uranium of 0.9006 for the AGR-1 kernels, 4151 particles are needed in each compact to obtain a uranium loading of 0.905 g. The average +18 Bin 3 overcoated particle weight was measured (according to AGR-CHAR-DAM-22, "Data Acquisition Method for Estimation of Average Particle Weight") to be $1.12 \cdot 10^{-3}$ g. Using this value, a compact charge of 4.65 g of +18 Bin 3 overcoated particles would be required for a compact uranium loading of 0.905 g. As an alternate approach for calculating the compact charge, a quantity of +18 Bin 3 overcoated particles was rinsed and the ratio of overcoated particle weight to TRISO particle weight was determined to be 1.560. 4151 particles corresponds to 3.043 g TRISO particles (given an average weight of AGR-1 baseline TRISO particle of $7.33 \cdot 10^{-4}$ g). Using this second approach, a compact charge of 4.75 g of +18 Bin 3 overcoated particles would be required for a compact uranium loading of 0.905 g. Based on these two determinations, an overcoated particle charge of 4.73 g was used to increase the probability that the actual uranium loading would be ≥ 0.905 g.

The 424 g quantity of +18 Bin 3 overcoated particles was rotary riffled into aliquots of approximately 4.30 g. Additional +18 Bin 3 overcoated particles were added to each aliquot by scoop sampling until the desired 4.73 g compact charge was reached. Compacts were then made from the 4.73 g aliquots. Steps were taken in the process to increase the malleability of the

overcoat, which helped aid the compaction process, densify the compact, and create a smoother, less porous outer surface. A 0.40 g quantity of matrix powder was added to the compacting mold prior to the addition of overcoated particles. Another 0.40g quantity of matrix was added to the mold after addition of the overcoated particles, such that the overcoated particles were compressed between two matrix "end caps" during fabrication. The compact is pressed by applying force to a top ram. The presence of the end caps helps to buffer the particles during compacting, and also provides a smooth, sharp end in the green compact.

85 AGR-1 variant 1 compacts were fabricated. All of the 85 green compacts were subsequently carbonized and heat treated. 79 compacts were selected from this batch of 85 and delivered to the characterization group. The selection of the 79 compacts for the characterization group was based on length measurements at each stage of compacting (green, carbonization, and heat-treatment), and visual inspection for surface irregularities.

AGR-1 Process Conditions

The AGR-1 process limits from EDF-4380, Rev. 8 are listed below.

AGR-1 Process Limits: Molding Pressure <60 MPa

Carbonization parameters: <350ºC/hr in He
Hold at 950 ± 50ºC for 1.0 ± 0.4 hr
Furnace cool

Heat treatment parameters: ~20ºC/min in vacuum
Hold at 1650-1850ºC for 60 ± 10 min
Furnace cool at ~20ºC/min to below 700ºC

Table 2-1 shows the process conditions used in molding the compacts, carbonizing the compacts, and heat treating the compacts. In the carbonization regime, the furnace was allowed to cool under no power (i.e., after holding at 950°C for 1 hour, power was turned off). In the heat treatment run, the furnace was cooled under power until the furnace temperature reached 700°C. The rate of cooling was 20°C/min.

Conclusion

The LEU01-47T-Z (Variant 1) compact lot was made in accordance with the AGR-1 process limits listed in EDF-4380, Rev. 8.

Table 2-1: Summary of process conditions used in making LEU01-47T-Z (AGR-1 variant 1) compacts

		Carbonization Parameter				Heat-treatment Parameters			
Compact ID	Molding Pressure (MPa)	Heating Rate (°C/min.)	Max. Temp. (°C)	Hold Time (hrs.)	Atmosphere	Heating Rate (°C/min.)	Max. Temp. (°C)	Hold Time (hrs.)	Atmosphere
LEU01-47T-Z01	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z02	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z03	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z04	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z05	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z06	8.91	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z07	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z08	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z09	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z10	7.8	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z11	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z12	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z13	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z14	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z15	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z16	8.91	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z17	8.91	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z18	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z19	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z20	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z21	5.57	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z22	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z23	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z24	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z25	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z26	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z27	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z28	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z29	8.91	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z30	8.91	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z31	8.91	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z32	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z33	8.91	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z34	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z35	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z36	8.54	4.7	950	1	flowing He	20	1800	1	vacuum

Task Manager Review Peter J. Pappano Date 8-1-06

QAS Review Date 8/1/06

Table 2-1 (cont.). Summary of process conditions used in making LEU01-47T-Z (AGR-1 variant 1) compacts

		Carbonization Parameter				Heat-treatment Parameters			
Compact ID	Molding Pressure (MPa)	Heating Rate (°C/min.)	Max. Temp. (°C)	Hold Time (hrs.)	Atmosphere	Heating Rate (°C/min.)	Max. Temp. (°C)	Hold Time (hrs.)	Atmosphere
LEU01-47T-Z37	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z38	9.28	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z39	8.91	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z40	8.91	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z41	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z42	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z43	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z44	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z45	8.91	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z46	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z47	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z48	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z49	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z50	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z51	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z52	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z53	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z54	8.91	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z55	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z56	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z57	9.28	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z58	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z59	9.28	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z60	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z61	9.28	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z62	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z63	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z64	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z65	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z66	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z67	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z68	8.91	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z69	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z70	8.91	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z71	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z72	8.54	4.7	950	1	flowing He	20	1800	1	vacuum

Task Manager Review Peter J. Pappano Date 8-1-06

QAS Review Date 8/1/06

Table 2-1 (cont.). Summary of process conditions used in making LEU01-47T-Z (AGR-1 variant 1) compacts

		Carbonization Parameter				Heat-treatment Parameters			
Compact ID	Molding Pressure (MPa)	Heating Rate (°C/min.)	Max. Temp. (°C)	Hold Time (hrs.)	Atmosphere	Heating Rate (°C/min.)	Max. Temp. (°C)	Hold Time (hrs.)	Atmosphere
LEU01-47T-Z73	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z74	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z75	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z76	8.17	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z77	8.91	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z78	8.54	4.7	950	1	flowing He	20	1800	1	vacuum
LEU01-47T-Z79	8.54	4.7	950	1	flowing He	20	1800	1	vacuum

Task Manager Review Peter I Pappano Date 8-1-06

QAS Review Date 8/1/06

3 Characterization of compacts

This section contains acceptance testing data on the compact lot LEU01-47T-Z. The data was obtained according to product inspection plan AGR-CHAR-PIP-05R0.

The following pages show the inspection report forms (IRF-05A, IRF-05B, IRF-05C, IRF-05D) for the LEU01-47T-Z compacts. Following the IRF-05 inspection report forms are the individual data report forms for the measurements that were performed. This compact lot was determined to satisfy the specifications in section 6.2 of the AGR-1 Fuel Product Specification and Characterization Guidance document INL EDF-4380, Rev. 8.

Inspection Report Form IRF-05A: Fuel Compact Lots

Procedure:	AGR-CHAR-PIP-05 Rev. 0
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID numbers of compacts available for irradiation test (pending acceptance):	04,06,07,08,10,11,12,13,17,18,19,20,21,23,24,25,28,30,32,33,35,36,38,42 47,49,51,52,53,55,56,57,59,60,62,63,64,65,66,67,68,69,70,71,72,74,77,79

Property	Measured Data Mean (x)	Std. Dev. (s)	Measurements (n)	k or t value	Specification INL EDF-4380 Rev. 8	Acceptance Criteria	Acceptance Test Value	Pass or fail	Data Records
Compact diameter (mm)	See DRF-24				12.22 - 12.46	all available for irradiation test meet specification		Pass	DRF-24
Compact length (mm)					25.02 - 25.40				
Uranium loading (gU/compact)	0.915	0.004	6	2.015	0.905 ± 0.04	A = x - ts/√n ≥ 0.865	0.912	pass	DRF-25
						B = x + ts/√n ≤ 0.945	0.918	pass	
Iron content outside SiC (µg/compact)	2.54	0.54	4	2.353	mean ≤ 25	B = x + ts/√n ≤ 25	3.2	pass	IRF-05B DRF-26
				7.042	dispersion ≤0.01 ≥ 100	D = x + √3ks < 100	9.1	pass	
Chromium content outside SiC (µg/compact)	1.62	0.02	4	2.353	mean ≤ 75	B = x + ts/√n ≤ 75	1.6	pass	IRF-05B DRF-26
Manganese content outside SiC (µg/compact)	0.25	0.04	4	2.353	mean ≤ 75	B = x + ts/√n ≤ 75	0.3	pass	IRF-05B DRF-26
Cobalt content outside SiC (µg/compact)	0.65	0.01	4	2.353	mean ≤ 75	B = x + ts/√n ≤ 75	0.7	pass	IRF-05B DRF-26
Nickel content outside SiC (µg/compact)	1.22	0.02	4	2.353	mean ≤ 75	B = x + ts/√n ≤ 75	1.2	pass	IRF-05B DRF-26
Cr + Mn + Co + Ni content outside SiC (µg/compact)	3.75	0.04	4	7.042	dispersion ≤0.01 ≥ 300	D = x + √3ks < 300	4.2	pass	IRF-05B DRF-26
Calcium content outside SiC (µg/compact)	21.65	3.07	4	2.353	mean ≤ 90	B = x + ts/√n ≤ 90	25.3	pass	IRF-05B DRF-26
Aluminum content outside SiC (µg/compact)	10.70	2.60	4	2.353	mean ≤ 45	B = x + ts/√n ≤ 45	13.8	pass	IRF-05B DRF-26
Ti + V content outside SiC (µg/compact)	30.87	0.72	4	2.353	mean ≤ 400	B = x + ts/√n ≤ 400	31.7	pass	IRF-05B DRF-26

Property	Measured Data # of compacts	# of particles	Specification INL EDF-4380	Acceptance Criteria	Acceptance Test Value	Pass or fail	Data Records
Uranium contamination fraction (g exposed U/gram U in compact)	18	74699	≤ 1.0×10^{-4}	≤4 effectively exposed kernels in ≥91533 particles or ≤2 effectively exposed kernels in ≥62956 particles	0	pass	IRF-05C DRF-26
Defective SiC coating fraction (fraction of total particles)	12	49799	≤ 2.0×10^{-4}	≤4 leached kernels in ≥45766 particles or ≤12 leached kernels in ≥97210 particles	0	pass	IRF-05D DRF-26
Defective IPyC coating fraction (fraction of total particles)	12	49799	≤ 2.0×10^{-4}	≤4 with excessive U dispersion in ≥45766 particles or ≤12 with excessive U dispersion in ≥97210 particles	0	pass	DRF-28
Defective OPyC coating fraction (fraction of total particles)	2	8300	≤ 0.01	≤6 cracked or missing OPyC in ≥1182 particles or ≤30 cracked or missing OPyC in ≥4064 particles	8	pass	DRF-27

Comments

Note 1: Per EDF-4380, a specification on Cl content outside SiC is not applicable because HCl cleaning of compacts was not performed.
Note 2: Only 18 compacts were available for determination of U contamination fraction. ≤2 defects in ≥62956 particles shows ≤1E-4 defect fraction to 95% confidence.

John Hunn
QC Supervisor

7-19-06
Date

Accept compact lot (Yes or No):	Yes

M. C. Davis
QA Reviewer

7/20/06
Date

Inspection Report Form IRF-05B: Summary of Impurites Outside SiC

Procedure:	AGR-CHAR-PIP-05 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact Lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T

Compact ID numbers:	05, 34, 46	31, 37, 54	02, 27, 40	26, 41, 48	Mean	Standard Deviation
Number of compacts:	3	3	3	3		
Iron						
Deconsolidation-leach (DRF-26A) (µg):	5.64	3.39	4.48	4.03		
Burn-leach (DRF-26B) (µg):	3.91	2.21	2.86	3.92		
Total leached (µg):	9.55	5.60	7.34	7.95		
Fe outside SiC (µg/compact):	**3.18**	**1.87**	**2.45**	**2.65**	**2.54**	**0.54**
Chromium						
Deconsolidation-leach (DRF-26A) (µg):	3.43	3.43	3.54	3.43		
Burn-leach (DRF-26B) (µg):	1.41	1.41	1.41	1.41		
Total leached (µg):	4.84	4.84	4.95	4.84		
Cr outside SiC (µg/compact):	**1.61**	**1.61**	**1.65**	**1.61**	**1.62**	**0.02**
Manganese						
Deconsolidation-leach (DRF-26A) (µg):	0.73	0.49	0.50	0.49		
Burn-leach (DRF-26B) (µg):	0.20	0.20	0.20	0.20		
Total leached (µg):	0.93	0.69	0.71	0.69		
Mn outside SiC (µg/compact):	**0.31**	**0.23**	**0.24**	**0.23**	**0.25**	**0.04**
Cobalt						
Deconsolidation-leach (DRF-26A) (µg):	1.37	1.37	1.41	1.37		
Burn-leach (DRF-26B) (µg):	0.56	0.56	0.56	0.56		
Total leached (µg):	1.93	1.93	1.97	1.93		
Co outside SiC (µg/compact):	**0.64**	**0.64**	**0.66**	**0.64**	**0.65**	**0.01**
Nickel						
Deconsolidation-leach (DRF-26A) (µg):	2.43	2.44	2.52	2.45		
Burn-leach (DRF-26B) (µg):	1.23	1.30	1.15	1.17		
Total leached (µg):	3.66	3.74	3.67	3.62		
Ni outside SiC (µg/compact):	**1.22**	**1.25**	**1.22**	**1.21**	**1.22**	**0.02**
Transition Metals						
Cr+Mn+Co+Ni outside SiC (µg/compact):	**3.79**	**3.74**	**3.77**	**3.70**	**3.75**	**0.04**
Calcium						
Deconsolidation-leach (DRF-26A) (µg):	53.30	48.00	32.90	30.30		
Burn-leach (DRF-26B) (µg):	23.21	20.18	24.90	26.97		
Total leached (µg):	76.51	68.18	57.80	57.27		
Ca outside SiC (µg/compact):	**25.50**	**22.73**	**19.27**	**19.09**	**21.65**	**3.07**
Aluminum						
Deconsolidation-leach (DRF-26A) (µg):	17.79	14.97	26.60	30.60		
Burn-leach (DRF-26B) (µg):	8.60	9.84	9.44	10.51		
Total leached (µg):	26.39	24.81	36.04	41.11		
Al outside SiC (µg/compact):	**8.80**	**8.27**	**12.01**	**13.70**	**10.70**	**2.60**
Titanium						
Deconsolidation-leach (DRF-26A) (µg):	10.47	12.42	14.88	13.36		
Burn-leach (DRF-26B) (µg):	22.94	20.07	20.14	19.62		
Total leached (µg):	33.41	32.49	35.02	32.98		
Ti outside SiC (µg/compact):	**11.14**	**10.83**	**11.67**	**10.99**	**11.16**	**0.37**
Vanadium						
Deconsolidation-leach (DRF-26A) (µg):	30.54	29.05	28.43	28.84		
Burn-leach (DRF-26B) (µg):	28.09	33.59	29.85	28.19		
Total leached (µg):	58.63	62.64	58.28	57.03		
V outside SiC (µg/compact):	**19.54**	**20.88**	**19.43**	**19.01**	**19.72**	**0.81**
Titanium and Vanadium						
Ti + V outside SiC (µg/compact):	**30.68**	**31.71**	**31.10**	**30.00**	**30.87**	**0.72**

QC Supervisor

5-16-06
Date

Inspection Report Form IRF-05C: Summary of Uranium Contamination

Procedure:	AGR-CHAR-PIP-05 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact Lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T

Compact ID numbers:	05, 34, 46	31, 37, 54	02, 27, 40	26, 41, 48		03, 16, 22, 58, 61, 73	Total
Number of compacts:	3	3	3	3		6	18
Effective number of exposed kernels:	0.0	0.0	0.0	0.0		0.0	0.0

QC Supervisor

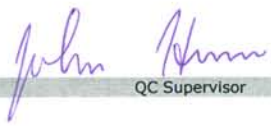
5-16-06

Date

Inspection Report Form IRF-05D: Summary of SiC Burn-Leach Defects

Procedure:	AGR-CHAR-PIP-05 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact Lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T

Compact ID numbers:	05, 34, 46	31, 37, 54	02, 27, 40	26, 41, 48			Total
Number of compacts:	3	3	3	3			12
Number of leached kernels:	0	0	0	0			0



QC Supervisor

5-16-06

Date

Data Report Form DRF-24: Compact Diameter and Length

Procedure:	AGR-CHAR-DAM-24 Rev. 3
Operator:	Ivan Dunbar
Compact lot ID:	LEU01-47T-Z
Compact Lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Filename:	\\mc-agr\AGR\CompactDimensions\LEU01-47T-Z_DRF24R3.xls

Vertical height gauge calibration due date:	9/8/06
Pass-thru block calibration due date:	1/17/09
Digital caliper calibration due date:	9/8/06
Gauge blocks calibration due date:	9/8/06

Acceptance criteria for compact length:	≥25.02 and ≤25.40 mm
Acceptance criteria for compact diameter:	≥12.22 and ≤12.46 mm (and pass through 12.46 mm ring gauge)
Acceptance criteria for compact mass:	For information only

Compact ID Number	Length (mm)	Diameter (mm)						Pass Thru? (Y or N)	Mass (g)	Accept? (pass or fail)
		Top 1	Top 2	Middle 1	Middle 2	Bottom 1	Bottom 2			
01	25.074	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3385	pass
02	25.134	12.36	12.36	12.36	12.36	12.35	12.36	Y	5.3532	pass
03	25.059	12.35	12.35	12.36	12.36	12.35	12.35	Y	5.3233	pass
04	25.173	12.36	12.37	12.37	12.36	12.35	12.36	Y	5.3408	pass
05	25.062	12.36	12.37	12.37	12.37	12.36	12.35	Y	5.3203	pass
06	25.092	12.36	12.36	12.37	12.37	12.36	12.36	Y	5.3316	pass
07	25.123	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3343	pass
08	25.148	12.37	12.36	12.36	12.36	12.36	12.36	Y	5.3325	pass
09	25.116	12.36	12.37	12.37	12.37	12.34	12.35	Y	5.3447	pass
10	25.116	12.37	12.36	12.37	12.37	12.35	12.35	Y	5.3327	pass
11	25.117	12.37	12.37	12.37	12.37	12.35	12.36	Y	5.3128	pass
12	25.031	12.36	12.37	12.37	12.37	12.35	12.36	Y	5.3288	pass
13	25.128	12.36	12.36	12.36	12.36	12.36	12.36	Y	5.3247	pass
14	25.135	12.35	12.36	12.36	12.36	12.35	12.35	Y	5.3427	pass
15	25.135	12.36	12.36	12.37	12.37	12.35	12.36	Y	5.3412	pass
16	25.152	12.37	12.37	12.37	12.37	12.36	12.36	Y	5.3459	pass
17	25.114	12.36	12.37	12.37	12.37	12.36	12.36	Y	5.3495	pass
18	25.121	12.37	12.36	12.37	12.37	12.36	12.36	Y	5.3225	pass
19	25.120	12.37	12.37	12.36	12.36	12.35	12.35	Y	5.3470	pass
20	25.143	12.36	12.37	12.36	12.37	12.36	12.36	Y	5.3532	pass
21	25.208	12.37	12.37	12.37	12.37	12.35	12.36	Y	5.3420	pass
22	25.161	12.37	12.37	12.37	12.37	12.35	12.36	Y	5.3389	pass
23	25.081	12.36	12.36	12.36	12.36	12.35	12.36	Y	5.3197	pass
24	25.063	12.36	12.37	12.37	12.37	12.35	12.36	Y	5.3006	pass
25	25.099	12.37	12.36	12.37	12.37	12.35	12.36	Y	5.3321	pass
26	25.083	12.36	12.36	12.37	12.37	12.36	12.35	Y	5.3373	pass
27	25.185	12.36	12.36	12.37	12.37	12.35	12.35	Y	5.3652	pass
28	25.099	12.37	12.37	12.37	12.37	12.35	12.35	Y	5.3477	pass
29	25.079	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3466	pass
30	25.141	12.37	12.37	12.37	12.37	12.35	12.35	Y	5.3533	pass
31	25.130	12.37	12.37	12.37	12.36	12.35	12.35	Y	5.3514	pass
32	25.133	12.36	12.36	12.37	12.36	12.35	12.36	Y	5.3471	pass
33	25.102	12.37	12.36	12.37	12.37	12.35	12.36	Y	5.3354	pass
34	25.120	12.36	12.36	12.36	12.37	12.35	12.35	Y	5.3312	pass
35	25.156	12.36	12.36	12.37	12.36	12.35	12.35	Y	5.3490	pass
36	25.088	12.37	12.37	12.37	12.37	12.36	12.36	Y	5.3584	pass
37	25.096	12.36	12.36	12.37	12.36	12.36	12.35	Y	5.3229	pass
38	25.111	12.37	12.37	12.37	12.37	12.36	12.36	Y	5.3382	pass
39	25.112	12.37	12.37	12.37	12.37	12.35	12.36	Y	5.3364	pass
40	25.143	12.36	12.36	12.37	12.36	12.35	12.36	Y	5.3455	pass

Comments

Page 1 of 2
For diameter measurement, top corresponds to compact end at top during pressing.
Top end cap appears shinier than bottom.

Operator — 4-12-06 Date

QC Supervisor — 5-11-06 Date

QA Reviewer — 5/16/06 Date

Data Report Form DRF-24: Compact Diameter and Length

Procedure:	AGR-CHAR-DAM-24 Rev. 3
Operator:	Ivan Dunbar
Compact lot ID:	LEU01-47T-Z
Compact Lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Filename:	\\mc-agr\AGR\CompactDimensions\LEU01-47T-Z_DRF24R3.xls

Vertical height gauge calibration due date:	9/8/06
Pass-thru block calibration due date:	1/17/09
Digital caliper calibration due date:	9/8/06
Gauge blocks calibration due date:	9/8/06

Acceptance criteria for compact length:	≥25.02 and ≤25.40 mm
Acceptance criteria for compact diameter:	≥12.22 and ≤12.46 mm (and pass through 12.46 mm ring gauge)
Acceptance criteria for compact mass:	For information only

Compact ID Number	Length (mm)	Diameter (mm)						Pass Thru? (Y or N)	Mass (g)	Accept? (pass or fail)
		Top 1	Top 2	Middle 1	Middle 2	Bottom 1	Bottom 2			
41	25.164	12.36	12.36	12.37	12.37	12.35	12.36	Y	5.3552	pass
42	25.134	12.36	12.37	12.37	12.37	12.35	12.35	Y	5.3515	pass
43	25.095	12.36	12.37	12.36	12.37	12.36	12.35	Y	5.3550	pass
44	25.203	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3534	pass
45	25.137	12.37	12.36	12.37	12.36	12.35	12.35	Y	5.3494	pass
46	25.044	12.36	12.36	12.36	12.37	12.36	12.35	Y	5.3499	pass
47	25.123	12.36	12.36	12.37	12.37	12.36	12.35	Y	5.3576	pass
48	25.097	12.36	12.36	12.36	12.36	12.35	12.36	Y	5.3355	pass
49	25.157	12.36	12.36	12.36	12.36	12.35	12.34	Y	5.3438	pass
50	25.076	12.36	12.36	12.36	12.37	12.35	12.35	Y	5.3249	pass
51	25.139	12.36	12.36	12.36	12.37	12.35	12.35	Y	5.3372	pass
52	25.101	12.35	12.36	12.37	12.37	12.35	12.35	Y	5.3324	pass
53	25.134	12.36	12.36	12.36	12.37	12.35	12.35	Y	5.3418	pass
54	25.123	12.36	12.36	12.37	12.37	12.35	12.35	Y	5.3522	pass
55	25.132	12.36	12.35	12.36	12.36	12.35	12.35	Y	5.3494	pass
56	25.079	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3358	pass
57	25.139	12.36	12.36	12.37	12.37	12.35	12.35	Y	5.3739	pass
58	25.147	12.35	12.35	12.36	12.36	12.34	12.34	Y	5.3624	pass
59	25.119	12.36	12.36	12.37	12.37	12.35	12.35	Y	5.3660	pass
60	25.110	12.37	12.37	12.36	12.37	12.35	12.36	Y	5.3445	pass
61	25.185	12.37	12.37	12.37	12.37	12.35	12.35	Y	5.3518	pass
62	25.100	12.36	12.36	12.36	12.36	12.34	12.35	Y	5.3370	pass
63	25.059	12.37	12.36	12.37	12.37	12.35	12.35	Y	5.3222	pass
64	25.087	12.36	12.36	12.37	12.37	12.35	12.35	Y	5.3395	pass
65	25.156	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3344	pass
66	25.124	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3350	pass
67	25.146	12.36	12.37	12.36	12.36	12.35	12.35	Y	5.3457	pass
68	25.126	12.37	12.37	12.36	12.37	12.35	12.34	Y	5.3470	pass
69	25.132	12.36	12.36	12.36	12.37	12.35	12.35	Y	5.3479	pass
70	25.036	12.37	12.37	12.37	12.36	12.35	12.36	Y	5.3219	pass
71	25.121	12.36	12.36	12.36	12.35	12.35	12.35	Y	5.3345	pass
72	25.138	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3267	pass
73	25.116	12.36	12.36	12.37	12.37	12.35	12.35	Y	5.3271	pass
74	25.114	12.36	12.36	12.36	12.36	12.35	12.35	Y	5.3263	pass
75	25.123	12.36	12.36	12.36	12.36	12.36	12.36	Y	5.3411	pass
76	25.137	12.37	12.37	12.37	12.37	12.35	12.35	Y	5.3467	pass
77	25.147	12.37	12.36	12.37	12.37	12.36	12.36	Y	5.3378	pass
78	25.068	12.37	12.36	12.37	12.36	12.35	12.35	Y	5.3320	pass
79	25.104	12.36	12.36	12.37	12.36	12.36	12.36	Y	5.3459	pass

Comments

Page 2 of 2
For diameter measurement, top corresponds to compact end at top during pressing.
Top end cap appears shinier than bottom.

Operator — Date: 4-12-06

QC Supervisor — Date: 5-11-06

QA Reviewer — Date: 5/16/06

Data Report Form DRF-25: Fuel Compact Mean Uranium Loading

Procedure:	AGR-CHAR-DAM-25 Rev. 1
Operator:	Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Filename:	\\mc-agr\AGR\UraniumLoading\LEU01-47T-Z_DRF25R1.xls

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Compact ID number:	1	14	29	43	44	78
Sample tube ID number:	U06041101	U06041102	U06041103	U06041104	U06041105	U06041106
Radiochemical laboratory analysis number:	060413-002	060413-003	060413-004	060413-005	060413-006	060413-007
Measured U in compact (g):	0.91071	0.92191	0.91563	0.91792	0.91234	0.91168
Uncertainty in measured U in compact (g):	0.00091	0.00092	0.00092	0.00092	0.00091	0.00091

Mean uranium loading (gU/compact):	0.915
Standard deviation in mean uranium loading (gU/compact):	0.004

Comments
checked against official results 5/02/06

Fred C. Montgomery
Operator

5-16-06
Date

Data Report Form DRF-26A: Measurement of U Contamination and Impurities by Deconsolidation Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID numbers:	05, 34, 46
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\LEU01-47T-Z_DRF26R0.xls

Mean average weight/kernel (g):	2.42E-04
Uncertainty in mean average weight/kernel (g):	5.96E-07
Mean weight % uranium/kernel:	90.06
Standard deviation in weight % uranium/kernel:	0.09
Approximate weight uranium/kernel (g):	2.18E-04
Uncertainty in approx. weight uranium/kernel (g):	5.76E-07

	First Leach	Second Leach	Total
Deconsolidation-leach solution ID:	L060419-001	L0604190102	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	060419-001	060428-002	
Weight uranium leached (g):	8.49E-07	3.96E-08	8.89E-07
Uncertainty in weight uranium leached (g):	8.50E-08	4.00E-09	8.51E-08
Effective number of exposed kernels:	0.0	0.0	0.0
Uncertainty in effective number of exposed kernels:	0.0	0.0	0.0
Fe content of leach solution (µg):	3.36	2.28	5.64
Uncertainty in measured Fe content (µg):	0.34	0.46	0.57
Cr content of leach solution (µg):	< 1.73	< 1.70	3.43
Uncertainty in measured Cr content (µg):			
Mn content of leach solution (µg):	0.49	< 0.24	0.73
Uncertainty in measured Mn content (µg):	0.10		0.10
Co content of leach solution (µg):	< 0.69	< 0.68	1.37
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	< 1.23	< 1.20	2.43
Uncertainty in measured Ni content (µg):			
Ca content of leach solution (µg):	32.30	21.00	53.30
Uncertainty in measured Ca content (µg):	3.20	2.10	3.83
Al content of leach solution (µg):	7.69	10.10	17.79
Uncertainty in measured Al content (µg):	1.50	2.00	2.50
Ti content of leach solution (µg):	3.63	6.84	10.47
Uncertainty in measured Ti content (µg):	0.73	1.40	1.58
V content of leach solution (µg):	24.20	6.34	30.54
Uncertainty in measured V content (µg):	2.40	0.63	2.48

Comments

Checked against official results by FCM on 5/15/06

Fred C. Montgomery
Operator

5-16-06
Date

Data Report Form DRF-26A: Measurement of U Contamination and Impurities by Deconsolidation Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID numbers:	31, 37, 54
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\LEU01-47T-Z_DRF26R0.xls

Mean average weight/kernel (g):	2.42E-04
Uncertainty in mean average weight/kernel (g):	5.96E-07
Mean weight % uranium/kernel:	90.06
Standard deviation in weight % uranium/kernel:	0.09
Approximate weight uranium/kernel (g):	2.18E-04
Uncertainty in approx. weight uranium/kernel (g):	5.76E-07

	First Leach	Second Leach	Total
Deconsolidation-leach solution ID:	L0604170301	L0604190302	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	060419-003	060428-004	
Weight uranium leached (g):	6.70E-07	3.31E-08	7.03E-07
Uncertainty in weight uranium leached (g):	6.70E-08	3.30E-09	6.71E-08
Effective number of exposed kernels:	0.0	0.0	0.0
Uncertainty in effective number of exposed kernels:	0.0	0.0	0.0
Fe content of leach solution (μg):	1.90	1.49	3.39
Uncertainty in measured Fe content (μg):	0.38	0.30	0.48
Cr content of leach solution (μg):	< 1.70	< 1.73	3.43
Uncertainty in measured Cr content (μg):			
Mn content of leach solution (μg):	< 0.24	< 0.25	0.49
Uncertainty in measured Mn content (μg):			
Co content of leach solution (μg):	< 0.68	< 0.69	1.37
Uncertainty in measured Co content (μg):			
Ni content of leach solution (μg):	< 1.21	< 1.23	2.44
Uncertainty in measured Ni content (μg):			
Ca content of leach solution (μg):	27.00	21.00	48.00
Uncertainty in measured Ca content (μg):	2.70	2.10	3.42
Al content of leach solution (μg):	7.25	7.72	14.97
Uncertainty in measured Al content (μg):	1.40	1.50	2.05
Ti content of leach solution (μg):	4.56	7.86	12.42
Uncertainty in measured Ti content (μg):	0.91	1.60	1.84
V content of leach solution (μg):	23.10	5.95	29.05
Uncertainty in measured V content (μg):	2.30	0.60	2.38

Comments

Checked against official results by FCM on 5/15/06

Fred C. Montgomery — Operator

5-16-06 — Date

Data Report Form DRF-26A: Measurement of U Contamination and Impurities by Deconsolidation Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID numbers:	02, 27, 40
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\LEU01-47T-Z_DRF26R0.xls

Mean average weight/kernel (g):	2.42E-04
Uncertainty in mean average weight/kernel (g):	5.96E-07
Mean weight % uranium/kernel:	90.06
Standard deviation in weight % uranium/kernel:	0.09
Approximate weight uranium/kernel (g):	2.18E-04
Uncertainty in approx. weight uranium/kernel (g):	5.76E-07

	First Leach	Second Leach	Total
Deconsolidation-leach solution ID:	L0604200101	L0604240102	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	060428-005	060428-008	
Weight uranium leached (g):	7.88E-07	2.88E-08	8.17E-07
Uncertainty in weight uranium leached (g):	7.90E-08	2.90E-09	7.91E-08
Effective number of exposed kernels:	0.0	0.0	0.0
Uncertainty in effective number of exposed kernels:	0.0	0.0	0.0
Fe content of leach solution (µg):	3.13	1.35	4.48
Uncertainty in measured Fe content (µg):	0.63	0.27	0.69
Cr content of leach solution (µg):	< 1.77	< 1.77	3.54
Uncertainty in measured Cr content (µg):			
Mn content of leach solution (µg):	< 0.25	< 0.25	0.50
Uncertainty in measured Mn content (µg):			
Co content of leach solution (µg):	< 0.71	< 0.71	1.41
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	< 1.26	< 1.26	2.52
Uncertainty in measured Ni content (µg):			
Ca content of leach solution (µg):	16.60	16.30	32.90
Uncertainty in measured Ca content (µg):	1.70	1.60	2.33
Al content of leach solution (µg):	15.90	10.70	26.60
Uncertainty in measured Al content (µg):	3.20	2.10	3.83
Ti content of leach solution (µg):	7.80	7.08	14.88
Uncertainty in measured Ti content (µg):	1.60	1.40	2.13
V content of leach solution (µg):	24.60	3.83	28.43
Uncertainty in measured V content (µg):	2.50	0.77	2.62

Comments

Checked against official results by FCM on 5/15/06

Fred C. Montgomery — Operator

5-16-06 — Date

Data Report Form DRF-26A: Measurement of U Contamination and Impurities by Deconsolidation Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID numbers:	26, 41, 48
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\LEU01-47T-Z_DRF26R0.xls

Mean average weight/kernel (g):	2.42E-04
Uncertainty in mean average weight/kernel (g):	5.96E-07
Mean weight % uranium/kernel:	90.06
Standard deviation in weight % uranium/kernel:	0.09
Approximate weight uranium/kernel (g):	2.18E-04
Uncertainty in approx. weight uranium/kernel (g):	5.76E-07

	First Leach	Second Leach	Total
Deconsolidation-leach solution ID:	L0604200201	L0604240202	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	060428-006	060428-009	
Weight uranium leached (g):	6.46E-07	2.70E-08	6.73E-07
Uncertainty in weight uranium leached (g):	6.50E-08	2.70E-09	6.51E-08
Effective number of exposed kernels:	0.0	0.0	0.0
Uncertainty in effective number of exposed kernels:	0.0	0.0	0.0
Fe content of leach solution (µg):	2.78	1.25	4.03
Uncertainty in measured Fe content (µg):	0.56	0.25	0.61
Cr content of leach solution (µg):	< 1.70	< 1.73	3.43
Uncertainty in measured Cr content (µg):			
Mn content of leach solution (µg):	< 0.24	< 0.25	0.49
Uncertainty in measured Mn content (µg):			
Co content of leach solution (µg):	< 0.68	< 0.69	1.37
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	1.22	< 1.23	2.45
Uncertainty in measured Ni content (µg):	0.24		0.24
Ca content of leach solution (µg):	15.40	14.90	30.30
Uncertainty in measured Ca content (µg):	1.50	3.00	3.35
Al content of leach solution (µg):	18.20	12.40	30.60
Uncertainty in measured Al content (µg):	3.60	2.50	4.38
Ti content of leach solution (µg):	6.82	6.54	13.36
Uncertainty in measured Ti content (µg):	1.40	1.30	1.91
V content of leach solution (µg):	24.70	4.14	28.84
Uncertainty in measured V content (µg):	2.50	0.83	2.63

Comments

Checked against official results by FCM on 5/15/06

Fred C. Montgomery — Operator

5-16-06 — Date

Data Report Form DRF-26A: Measurement of U Contamination and Impurities by Deconsolidation Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID numbers:	09, 15, 39, 45, 75, 76
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\LEU01-47T-Z_DRF26R0.xls

Mean average weight/kernel (g):	2.42E-04
Uncertainty in mean average weight/kernel (g):	5.96E-07
Mean weight % uranium/kernel:	90.06
Standard deviation in weight % uranium/kernel:	0.09
Approximate weight uranium/kernel (g):	2.18E-04
Uncertainty in approx. weight uranium/kernel (g):	5.76E-07

	First Leach	Second Leach	Total
Deconsolidation-leach solution ID:			
Number of compacts:	6		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:			
Weight uranium leached (g):			
Uncertainty in weight uranium leached (g):			
Effective number of exposed kernels:			
Uncertainty in effective number of exposed kernels:			
Fe content of leach solution (μg):			
Uncertainty in measured Fe content (μg):			
Cr content of leach solution (μg):			
Uncertainty in measured Cr content (μg):			
Mn content of leach solution (μg):			
Uncertainty in measured Mn content (μg):			
Co content of leach solution (μg):			
Uncertainty in measured Co content (μg):			
Ni content of leach solution (μg):			
Uncertainty in measured Ni content (μg):			
Ca content of leach solution (μg):			
Uncertainty in measured Ca content (μg):			
Al content of leach solution (μg):			
Uncertainty in measured Al content (μg):			
Ti content of leach solution (μg):			
Uncertainty in measured Ti content (μg):			
V content of leach solution (μg):			
Uncertainty in measured V content (μg):			

Comments

Leachates lost when centrifuge tubes broke while being centrifuged

Fred C. Montgomery — Operator

5-16-06 — Date

Data Report Form DRF-26A: Measurement of U Contamination and Impurities by Deconsolidation Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID numbers:	03, 16, 22, 58, 61, 73
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\LEU01-47T-Z_DRF26R0.xls

Mean average weight/kernel (g):	2.42E-04
Uncertainty in mean average weight/kernel (g):	5.96E-07
Mean weight % uranium/kernel:	90.06
Standard deviation in weight % uranium/kernel:	0.09
Approximate weight uranium/kernel (g):	2.18E-04
Uncertainty in approx. weight uranium/kernel (g):	5.76E-07

	First Leach	Second Leach	Total
Deconsolidation-leach solution ID:	L0604240501	L0604260102	
Number of compacts:	6		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	060428-011	060428-012	
Weight uranium leached (g):	1.39E-06	6.08E-08	1.45E-06
Uncertainty in weight uranium leached (g):	1.40E-07	6.10E-09	1.40E-07
Effective number of exposed kernels:	0.0	0.0	0.0
Uncertainty in effective number of exposed kernels:	0.0	0.0	0.0
Fe content of leach solution (μg):	5.24	2.05	7.29
Uncertainty in measured Fe content (μg):	0.52	0.41	0.66
Cr content of leach solution (μg):	< 2.69	< 2.69	5.38
Uncertainty in measured Cr content (μg):			
Mn content of leach solution (μg):	< 0.38	< 0.38	0.77
Uncertainty in measured Mn content (μg):			
Co content of leach solution (μg):	< 1.07	< 1.07	2.14
Uncertainty in measured Co content (μg):			
Ni content of leach solution (μg):	< 1.91	< 1.91	3.82
Uncertainty in measured Ni content (μg):			
Ca content of leach solution (μg):	43.20	20.60	63.80
Uncertainty in measured Ca content (μg):	4.30	4.10	5.94
Al content of leach solution (μg):	24.20	12.60	36.80
Uncertainty in measured Al content (μg):	4.80	2.50	5.41
Ti content of leach solution (μg):	3.88	3.61	7.49
Uncertainty in measured Ti content (μg):	0.78	0.72	1.06
V content of leach solution (μg):	43.10	13.90	57.00
Uncertainty in measured V content (μg):	4.30	1.40	4.52

Comments

Checked against official results by FCM on 5/15/06

Fred C. Montgomery
Operator

5-16-06
Date

Data Report Form DRF-26B: Measurement of SiC Burn-Leach Defects and Impurities by Burn-Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID numbers:	05, 34, 46
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\LEU01-47T-Z_DRF26R0.xls

Mean average weight/kernel (g):	2.42E-04
Uncertainty in mean average weight/kernel (g):	5.96E-07
Mean weight % uranium/kernel:	90.06
Standard deviation in weight % uranium/kernel:	0.09
Approximate weight uranium/kernel (g):	2.18E-04
Uncertainty in approx. weight uranium/kernel (g):	5.76E-07

	First Leach	Second Leach	Total
Burn-leach solution ID:	B0604280101	B0605010102	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	060502-013	060502-019	
Weight uranium leached (g):	1.25E-07	1.00E-09	1.26E-07
Uncertainty in weight uranium leached (g):	1.30E-08	1.00E-10	1.30E-08
Number of leached kernels:	0.0	0.0	0.0
Uncertainty in number of leached kernels:	0.0	0.0	0.0
Fe content of leach solution (μg):	3.48	0.43	3.91
Uncertainty in measured Fe content (μg):	0.35	0.09	0.36
Cr content of leach solution (μg):	< 0.71	< 0.71	1.41
Uncertainty in measured Cr content (μg):			
Mn content of leach solution (μg):	< 0.10	< 0.10	0.20
Uncertainty in measured Mn content (μg):			
Co content of leach solution (μg):	< 0.28	< 0.28	0.56
Uncertainty in measured Co content (μg):			
Ni content of leach solution (μg):	0.73	< 0.50	1.23
Uncertainty in measured Ni content (μg):	0.15		0.15
Ca content of leach solution (μg):	17.80	5.41	23.21
Uncertainty in measured Ca content (μg):	1.80	1.10	2.11
Al content of leach solution (μg):	5.87	< 2.73	8.60
Uncertainty in measured Al content (μg):	1.20		1.20
Ti content of leach solution (μg):	21.80	1.14	22.94
Uncertainty in measured Ti content (μg):	2.20	0.23	2.21
V content of leach solution (μg):	27.70	< 0.39	28.09
Uncertainty in measured V content (μg):	2.80		2.80

Comments

Checked against official results by FCM on 5/15/06

Fred C. Montgomery — Operator

5-16-06 — Date

Data Report Form DRF-26B: Measurement of SiC Burn-Leach Defects and Impurities by Burn-Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID numbers:	31, 37, 54
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\LEU01-47T-Z_DRF26R0.xls

Mean average weight/kernel (g):	2.42E-04
Uncertainty in mean average weight/kernel (g):	5.96E-07
Mean weight % uranium/kernel:	90.06
Standard deviation in weight % uranium/kernel:	0.09
Approximate weight uranium/kernel (g):	2.18E-04
Uncertainty in approx. weight uranium/kernel (g):	5.76E-07

	First Leach	Second Leach	Total
Burn-leach solution ID:	B0604280301	B0605010302	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	060502-015	060502-021	
Weight uranium leached (g):	1.02E-07	1.00E-09	1.03E-07
Uncertainty in weight uranium leached (g):	1.00E-08	1.00E-10	1.00E-08
Number of leached kernels:	0.0	0.0	0.0
Uncertainty in number of leached kernels:	0.0	0.0	0.0
Fe content of leach solution (µg):	1.85	0.36	2.21
Uncertainty in measured Fe content (µg):	0.19	0.07	0.20
Cr content of leach solution (µg):	< 0.71	< 0.71	1.41
Uncertainty in measured Cr content (µg):			
Mn content of leach solution (µg):	< 0.10	< 0.10	0.20
Uncertainty in measured Mn content (µg):			
Co content of leach solution (µg):	< 0.28	< 0.28	0.56
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	0.80	< 0.50	1.30
Uncertainty in measured Ni content (µg):	0.16		0.16
Ca content of leach solution (µg):	16.10	4.08	20.18
Uncertainty in measured Ca content (µg):	1.60	0.82	1.80
Al content of leach solution (µg):	7.11	< 2.73	9.84
Uncertainty in measured Al content (µg):	1.40		1.40
Ti content of leach solution (µg):	18.60	1.47	20.07
Uncertainty in measured Ti content (µg):	1.90	0.29	1.92
V content of leach solution (µg):	33.20	< 0.39	33.59
Uncertainty in measured V content (µg):	3.30		3.30

Comments

Checked against official results by FCM on 5/15/06

Fred C. Montgomery
Operator

5-16-06
Date

Data Report Form DRF-26B: Measurement of SiC Burn-Leach Defects and Impurities by Burn-Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID numbers:	02, 27, 40
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\LEU01-47T-Z_DRF26R0.xls

Mean average weight/kernel (g):	2.42E-04
Uncertainty in mean average weight/kernel (g):	5.96E-07
Mean weight % uranium/kernel:	90.06
Standard deviation in weight % uranium/kernel:	0.09
Approximate weight uranium/kernel (g):	2.18E-04
Uncertainty in approx. weight uranium/kernel (g):	5.76E-07

	First Leach	Second Leach	Total
Burn-leach solution ID:	B0604290101	B0605010402	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	060502-016	060502-022	
Weight uranium leached (g):	1.06E-07	1.00E-09	1.07E-07
Uncertainty in weight uranium leached (g):	1.10E-08	1.00E-10	1.10E-08
Number of leached kernels:	0.0	0.0	0.0
Uncertainty in number of leached kernels:	0.0	0.0	0.0
Fe content of leach solution (µg):	2.52	0.34	2.86
Uncertainty in measured Fe content (µg):	0.25	0.07	0.26
Cr content of leach solution (µg):	< 0.71	< 0.71	1.41
Uncertainty in measured Cr content (µg):			
Mn content of leach solution (µg):	< 0.10	< 0.10	0.20
Uncertainty in measured Mn content (µg):			
Co content of leach solution (µg):	< 0.28	< 0.28	0.56
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	0.65	< 0.50	1.15
Uncertainty in measured Ni content (µg):	0.13		0.13
Ca content of leach solution (µg):	20.90	4.00	24.90
Uncertainty in measured Ca content (µg):	2.10	0.80	2.25
Al content of leach solution (µg):	6.71	< 2.73	9.44
Uncertainty in measured Al content (µg):	1.30		1.30
Ti content of leach solution (µg):	18.90	1.24	20.14
Uncertainty in measured Ti content (µg):	1.90	0.25	1.92
V content of leach solution (µg):	29.40	0.45	29.85
Uncertainty in measured V content (µg):	2.90	0.09	2.90

Comments

Checked against official results by FCM on 5/15/06

Fred C. Montgomery — Operator

5-16-06 — Date

Data Report Form DRF-26B: Measurement of SiC Burn-Leach Defects and Impurities by Burn-Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID numbers:	26, 41, 48
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\LEU01-47T-Z_DRF26R0.xls

Mean average weight/kernel (g):	2.42E-04
Uncertainty in mean average weight/kernel (g):	5.96E-07
Mean weight % uranium/kernel:	90.06
Standard deviation in weight % uranium/kernel:	0.09
Approximate weight uranium/kernel (g):	2.18E-04
Uncertainty in approx. weight uranium/kernel (g):	5.76E-07

	First Leach	Second Leach	Total
Burn-leach solution ID:	B0604290301	B0605010602	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	060502-018	060502-024	
Weight uranium leached (g):	1.09E-07	3.00E-09	1.12E-07
Uncertainty in weight uranium leached (g):	1.10E-08	3.00E-10	1.10E-08
Number of leached kernels:	0.0	0.0	0.0
Uncertainty in number of leached kernels:	0.0	0.0	0.0
Fe content of leach solution (µg):	3.35	0.57	3.92
Uncertainty in measured Fe content (µg):	0.34	0.11	0.36
Cr content of leach solution (µg):	< 0.71	< 0.71	1.41
Uncertainty in measured Cr content (µg):			
Mn content of leach solution (µg):	< 0.10	< 0.10	0.20
Uncertainty in measured Mn content (µg):			
Co content of leach solution (µg):	< 0.28	< 0.28	0.56
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	0.67	< 0.50	1.17
Uncertainty in measured Ni content (µg):	0.13		0.13
Ca content of leach solution (µg):	20.40	6.57	26.97
Uncertainty in measured Ca content (µg):	2.00	0.66	2.11
Al content of leach solution (µg):	7.78	< 2.73	10.51
Uncertainty in measured Al content (µg):	1.60		1.60
Ti content of leach solution (µg):	17.90	1.72	19.62
Uncertainty in measured Ti content (µg):	1.80	0.34	1.83
V content of leach solution (µg):	27.80	< 0.39	28.19
Uncertainty in measured V content (µg):	2.80		2.80

Comments

Checked against official results by FCM on 5/15/06

Fred C. Montgomery — Operator

5-16-06 — Date

Summary of analysis for defective OPyC coating fraction after compacting.

The procedure in AGR-CHAR-DAM-27R0, "Data Acquisition Method for Counting of Particles with Missing or Defective OPyC Layers from Deconsolidated Compacts by Visual Inspection," was performed multiple times for AGR-1 variant 1 compact lot LEU01-47T-Z. A completed DRF-27 is included in the following pages for each analysis performed. The deconsolidation tube used for previous measurements was broken prior to beginning this analysis. It was determined that the first replacement tube, which had a smaller ID, was causing the OPyC layer on some particles to fracture during the deconsolidation process. This tube was replaced with a larger diameter tube which solved the problem.

Compact LEU01-47T-Z50 was first submitted for defective OPyC analysis per AGR-CHAR-PIP-05R1. The compact was deconsolidated in an 18 mm ID tube. 471 particles with defective OPyC were identified. This result was suspect because previous measurements on compacts produced using a similar method found no defects.

Compacts LEU01-47T-Z(09, 15, 39, 45, 75, 76) were deconsolidated for uranium contamination analysis per AGR-CHAR-DAM-26R0, "Data Acquisition Method for Measurement of U Contamination, Defective SiC Coating Fraction, and Impurities in Fuel Compacts by the Leach-Burn-Leach Method." The deconsolidation procedure for this analysis is the same as in AGR-CHAR-DAM-27R0. These compacts had also been deconsolidated in an 18 mm ID tube. The particles were examined for defective OPyC and 607 particles were identified.

When compact lot LEU01-47T-Z was fabricated, several extra compacts were made that were not included in the 79 compacts selected for inclusion in the LEU01-47T-Z compact lot. These extra compacts were, however, fabricated at the same time, from the same overcoated particle composite, and under the same conditions as those in the LEU01-47T-Z compact lot. The extra compacts were identified as LEU01-47T-G## (where ## indicated the sequence in which they were fabricated).

Compact LEU01-47T-G03 was deconsolidated in a 22 mm ID tube. No particles with defective OPyC were identified. Compact LEU01-47T-G75 was also deconsolidated in a 22 mm ID tube. 8 particles with defective OPyC were identified. (It is possible that the 8 particles with missing OPyC from G75 were the result of damage from sieving after deconsolidation). Compact LEU01-47T-G22 was deconsolidated in an 18 mm ID tube. 486 particles with defective OPyC were identified.

The results of these five measurements on AGR-1 variant 1 compacts indicate that the observed OPyC failure is related to the use of the 18 mm ID tube during deconsolidation. Additional results of defective OPyC analysis on AGR-1 baseline compacts provide further evidence. Compact LEU01-46T-Z06 was deconsolidated in a 22 mm ID tube and no particles with defective OPyC were identified. The particles from compacts LEU01-46T-Z(25, 41, 51, 63, 70, 73), which were previously deconsolidated for uranium contamination analysis in a 22 mm ID tube, were examined for defective OPyC and no particles with defective OPyC were found. Finally, compact LEU01-46T-G20 (representative of compact lot LEU01-46T-Z) was deconsolidated in an 18 mm ID tube and 315 particles with defective OPyC were observed.

For the purpose of this acceptance test, the results of defective OPyC analysis using an 18 mm ID tube are considered to be invalid due to the evidence that deconsolidation in this size tube results in damage to the OPyC. The two analyses performed using the 22 mm ID tube are considered valid and compacts LEU01-47T-G03 and LEU01-47T-G75 are considered representative of the compact lot LEU01-47T-Z. Therefore, the results obtained for compacts LEU01-47T-G03 and LEU01-47T-G75 have been used to ascertain the acceptability of compact lot LEU01-47T-Z with respect to the defective OPyC coating fraction specification. The exact mechanism by which the 18 mm ID tube produces OPyC damage is uncertain and determination of this mechanism would require further investigation.

Data Report Form DRF-27: Counting of Particles with a Defective OPyC Layer from Deconsolidated Compacts by Visual Inspection

Procedure:	AGR-CHAR-DAM-27 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID number:	50
DRF filename:	\\mc-agr\AGR\DefectiveOPyC\LEU01-47T-Z_DRF27R0_A.xls

Number of particles with cracked OPyC:	233
Number of particles with partially missing OPyC:	0
Number of particles with completely missing OPyC:	238
Total number of particles with defective OPyC:	471

Comments on unusual visual characteristics of OPyC

The number of cracked OPyC also includes particles with partially missing OPyC.
This compact was deconsolidated in the 18 mm inner diameter deconsolidation tube. It has been determined that use of this tube results in broken OPyC as an artifact of the deconsolidation process.

Fred C. Montgomery — Operator

7-07-06 — Date

Data Report Form DRF-27: Counting of Particles with a Defective OPyC Layer from Deconsolidated Compacts by Visual Inspection

Procedure:	AGR-CHAR-DAM-27 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID number:	09,15,39,45,75,76
DRF filename:	\\mc-agr\AGR\DefectiveOPyC\LEU01-47T-Z_DRF27R0_B.xls

Number of particles with cracked OPyC:	411
Number of particles with partially missing OPyC:	0
Number of particles with completely missing OPyC:	196
Total number of particles with defective OPyC:	607

Comments on unusual visual characteristics of OPyC

Defective OPyC analysis was repeated for compact lot LEU01-47T-Z using particles that were deconsolidated from a set of 6 compacts for U contamination analysis per AGR-CHAR-DAM-26.
These compacts were deconsolidated in the 18 mm inner diameter deconsolidation tube. It has been determined that use of this tube results in broken OPyC as an artifact of the deconsolidation process.
The number of cracked OPyC also includes particles with partially missing OPyC.

Fred C. Montgomery — Operator

7-7-06 — Date

Data Report Form DRF-27: Counting of Particles with a Defective OPyC Layer from Deconsolidated Compacts by Visual Inspection

Procedure:	AGR-CHAR-DAM-27 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID number:	G03
DRF filename:	\\mc-agr\AGR\DefectiveOPyC\LEU01-47T-Z_DRF27R0_D.xls

Number of particles with cracked OPyC:	0
Number of particles with partially missing OPyC:	0
Number of particles with completely missing OPyC:	0
Total number of particles with defective OPyC:	0

Comments on unusual visual characteristics of OPyC

Compact LEU01-47T-G03 was submitted for defective OPyC analysis. This compact was not included in the 79 variant 1 compacts originally submitted as compact lot LEU01-47T-Z per AGR-CHAR-PIP-05. However, LEU01-47T-G03 was compacted at the same time, from the same overcoated particle composite, and under the same conditions as the compacts in lot LEU01-47T-Z.
This compact was deconsolidated in the 22 mm inner diameter deconsolidation tube. It has been determined that use of this tube does not result in broken OPyC as an artifact of the deconsolidation process.

Fred C. Montgomery — Operator

7-7-06 — Date

Data Report Form DRF-27: Counting of Particles with a Defective OPyC Layer from Deconsolidated Compacts by Visual Inspection

Procedure:	AGR-CHAR-DAM-27 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID number:	G75
DRF filename:	\\mc-agr\AGR\DefectiveOPyC\LEU01-47T-Z_DRF27R0_C.xls

Number of particles with cracked OPyC:	0
Number of particles with partially missing OPyC:	0
Number of particles with completely missing OPyC:	8
Total number of particles with defective OPyC:	8

Comments on unusual visual characteristics of OPyC

Compact LEU01-47T-G75 was submitted for defective OPyC analysis. This compact was not included in the 79 variant 1 compacts originally submitted as compact lot LEU01-47T-Z per AGR-CHAR-PIP-05. However, LEU01-47T-G75 was compacted at the same time, from the same overcoated particle composite, and under the same conditions as the compacts in lot LEU01-47T-Z.
This compact was deconsolidated in the 22 mm inner diameter deconsolidation tube. It has been determined that use of this tube does not result in broken OPyC as an artifact of the deconsolidation process.

Fred C. Montgomery
Operator

7-7-06
Date

Data Report Form DRF-27: Counting of Particles with a Defective OPyC Layer from Deconsolidated Compacts by Visual Inspection

Procedure:	AGR-CHAR-DAM-27 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID number:	G22
DRF filename:	\\mc-agr\AGR\DefectiveOPyC\LEU01-47T-Z_DRF27R0_E.xls

Number of particles with cracked OPyC:	138
Number of particles with partially missing OPyC:	0
Number of particles with completely missing OPyC:	348
Total number of particles with defective OPyC:	486

Comments on unusual visual characteristics of OPyC

Compact LEU01-47T-G22 was submitted for defective OPyC analysis. This compact was not included in the 79 variant 1 compacts originally submitted as compact lot LEU01-47T-Z per AGR-CHAR-PIP-05. However, LEU01-47T-G22 was compacted at the same time, from the same overcoated particle composite, and under the same conditions as the compacts in lot LEU01-47T-Z.
This compact was deconsolidated in the 18 mm inner diameter deconsolidation tube. It has been determined that use of this tube results in broken OPyC as an artifact of the deconsolidation process.
The number of cracked OPyC also includes particles with partially missing OPyC.

Fred C. Montgomery — Operator

7-7-06 — Date

Data Report Form DRF-27: Counting of Particles with a Defective OPyC Layer from Deconsolidated Compacts by Visual Inspection

Procedure:	AGR-CHAR-DAM-27 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-46T-Z
Compact lot description:	Compacts of AGR-1 baseline coated particle composite LEU01-46T
Compact ID number:	6
DRF filename:	\\mc-agr\AGR\DefectiveOPyC\LEU01-47T-Z_DRF27R0.xls

Number of particles with cracked OPyC:	0
Number of particles with partially missing OPyC:	0
Number of particles with completely missing OPyC:	0
Total number of particles with defective OPyC:	0

Comments on unusual visual characteristics of OPyC

<5 particles still had a thin layer of the matrix present. No agglomerates in the population.

Fred C. Montgomery
Operator

5/3/06
Date

Data Report Form DRF-27: Counting of Particles with a Defective OPyC Layer from Deconsolidated Compacts by Visual Inspection

Procedure:	AGR-CHAR-DAM-27 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-46T-Z
Compact lot description:	Compacts of AGR-1 baseline coated particle composite LEU01-46T
Compact ID number:	25, 41, 51, 63, 70, 73
DRF filename:	\\mc-agr\AGR\DefectiveOPyC\LEU01-46T-Z25_41_51_63_70_73_DRF27R0.xls

Number of particles with cracked OPyC:	0
Number of particles with partially missing OPyC:	0
Number of particles with completely missing OPyC:	0
Total number of particles with defective OPyC:	0

Comments on unusual visual characteristics of OPyC

This compact was deconsolidated in the 22 mm inner diameter deconsolidation tube. It has been determined that use of this tube does not result in broken OPyC as an artifact of the deconsolidation process.
examined 5/11/06

Fred C. Montgomery
Operator

7-7-06
Date

Data Report Form DRF-27: Counting of Particles with a Defective OPyC Layer from Deconsolidated Compacts by Visual Inspection

Procedure:	AGR-CHAR-DAM-27 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	LEU01-46T-Z
Compact lot description:	Compacts of AGR-1 baseline coated particle composite LEU01-46T
Compact ID number:	G20
DRF filename:	\\mc-agr\AGR\DefectiveOPyC\LEU01-46T-Z_DRF27R0_C.xls

Number of particles with cracked OPyC:	62
Number of particles with partially missing OPyC:	0
Number of particles with completely missing OPyC:	253
Total number of particles with defective OPyC:	315

Comments on unusual visual characteristics of OPyC

Compact LEU01-46T-G20 was submitted for defective OPyC analysis. This compact was not included in the 79 baseline compacts originally submitted as compact lot LEU01-46T-Z per AGR-CHAR-PIP-05. However, LEU01-46T-G20 was compacted at the same time, from the same overcoated particle composite, and under the same conditions as the compacts in lot LEU01-46T-Z.
This compact was deconsolidated in the 18 mm inner diameter deconsolidation tube. It has been determined that use of this tube results in broken OPyC as an artifact of the deconsolidation process.
The number of cracked OPyC also includes particles with partially missing OPyC.

Fred C. Montgomery — Operator

7-7-06 — Date

Data Report Form DRF-28: Counting of Particles with Excessive Uranium Dispersion Inside SiC

Procedure:	AGR-CHAR-DAM-28 Rev. 1
Operator:	John Hunn
Compact lot ID:	LEU01-47T-Z
Compact lot description:	Compacts of AGR-1 variant 1 coated particle composite LEU01-47T
Compact ID numbers:	05,34,46,31,37,54,02,27,40,26,41,48
DRF filename:	\\mc-agr\AGR\DefectiveIPyC\LEU01-47T-Z_DRF28R1.xls

Number of compacts from which particles were recovered:	12

Weight of sample of particles (g):	29.196
Number of particles in sample:	49799
Mean average weight/particle (g):	5.86E-04

Number of particles with excessive U dispersion:	0

Comments

Particles noted with <300 μm diameter kernel: 20/49799 (fraction of compact lot with this anomaly: ≤5.9E-4 at 95% confidence).
Particles noted with <20 μm thick SiC: 28/49799 (fraction of compact lot with this anomaly: ≤7.8E-4 at 95% confidence).
Other anomalies observed included highly aspherical kernel shapes, faceted particles, and defects related to goldspots (soot inclusions).

John Hunn
Operator

7-5-06
Date

For Information Only

The information in the remainder of this section is from additional characterization that was not required by the fuel product specification.

A. Images of AGR-1 variant 1 compact lot LEU01-47T-Z

The following images are of two compacts randomly selected from compact lot LEU01-47T-Z.

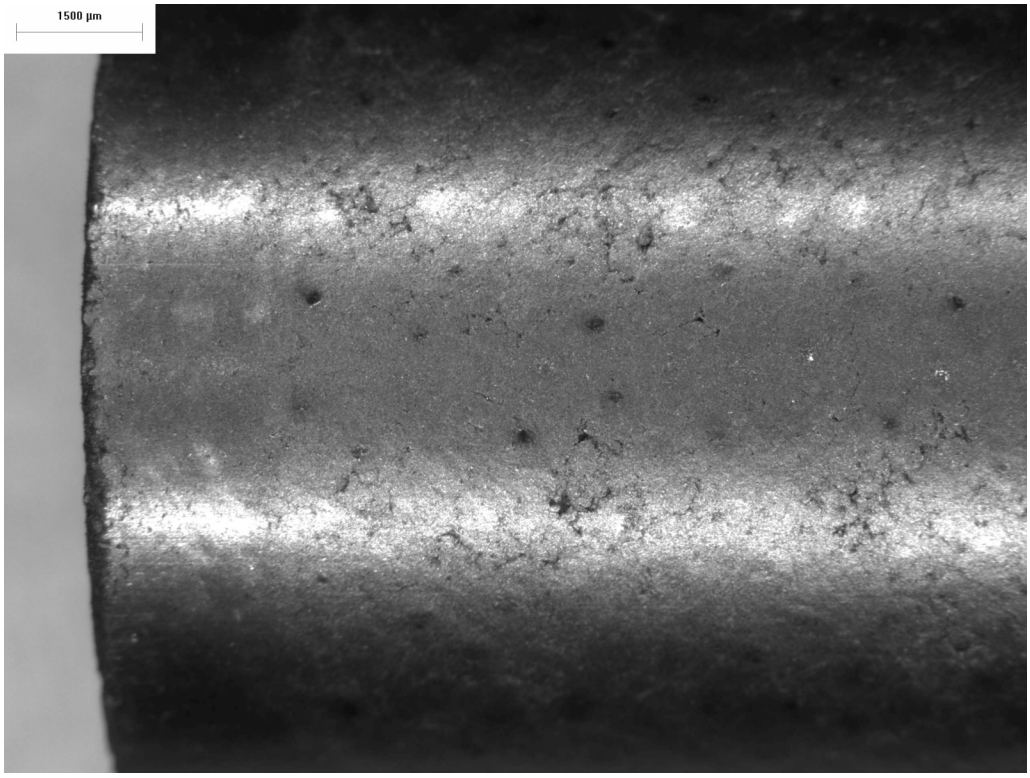


Figure A-1: Bottom of compact LEU01-47T-Z10 (8th compact fabricated).

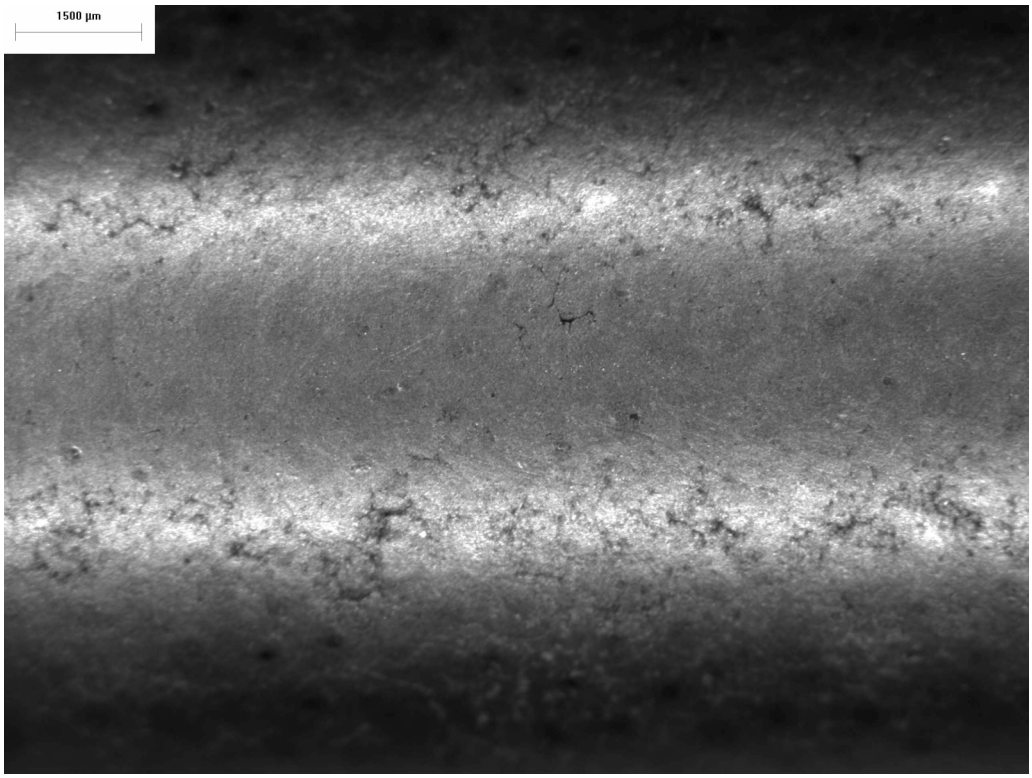


Figure A-2: Middle of compact LEU01-47T-Z10 (8th compact fabricated).

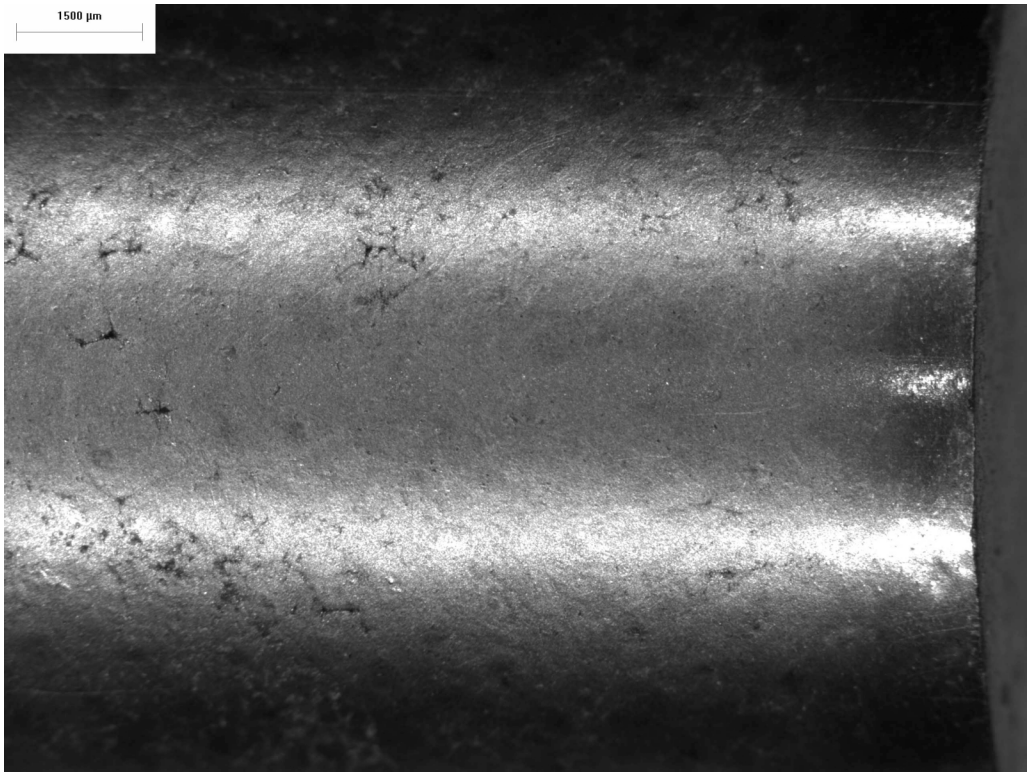


Figure A-3: Top of compact LEU01-47T-Z10 (8th compact fabricated).

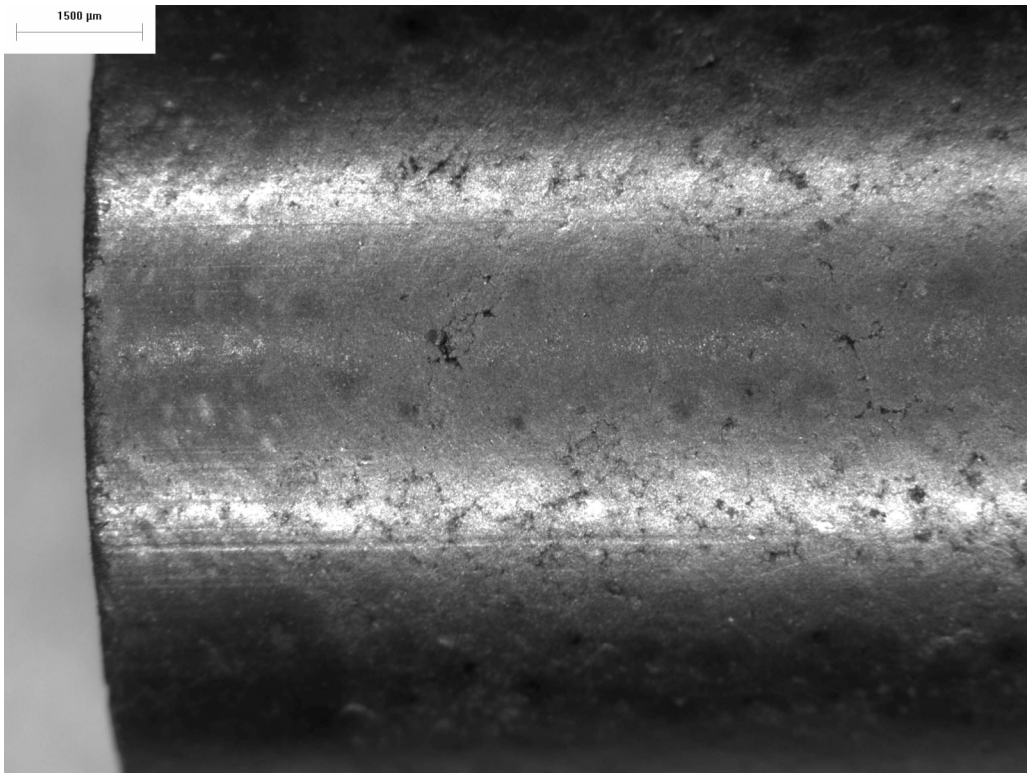


Figure A-4: Bottom of compact LEU01-47T-Z11 (32nd compact fabricated).

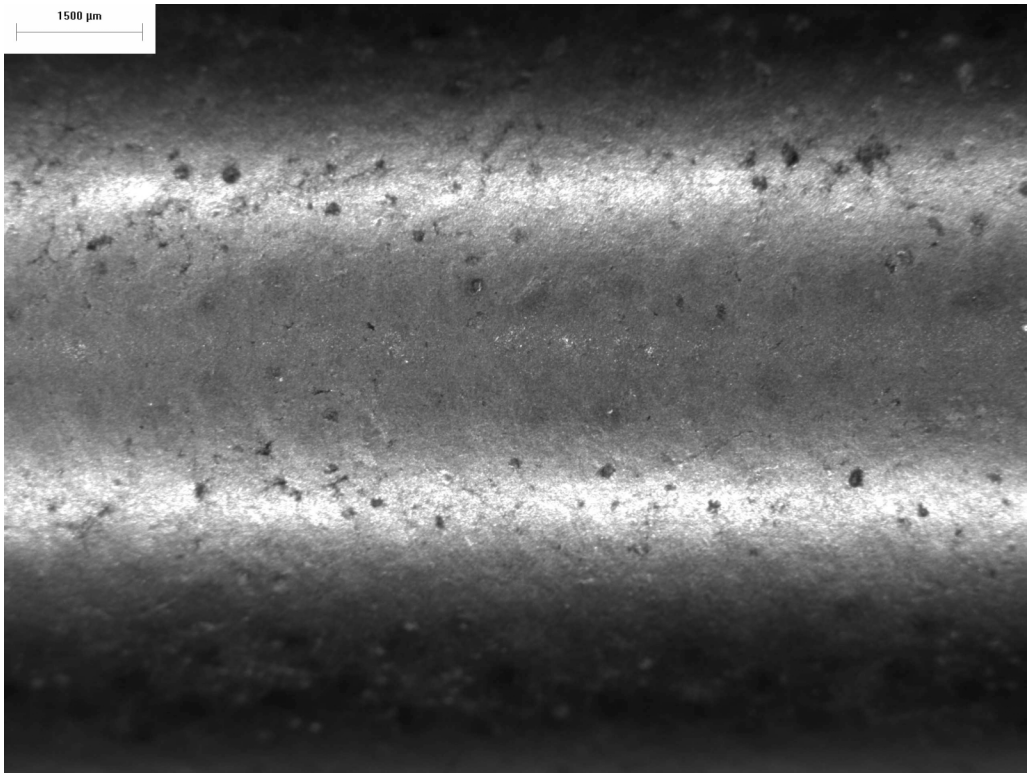


Figure A-5: Middle of compact LEU01-47T-Z11 (32nd compact fabricated).

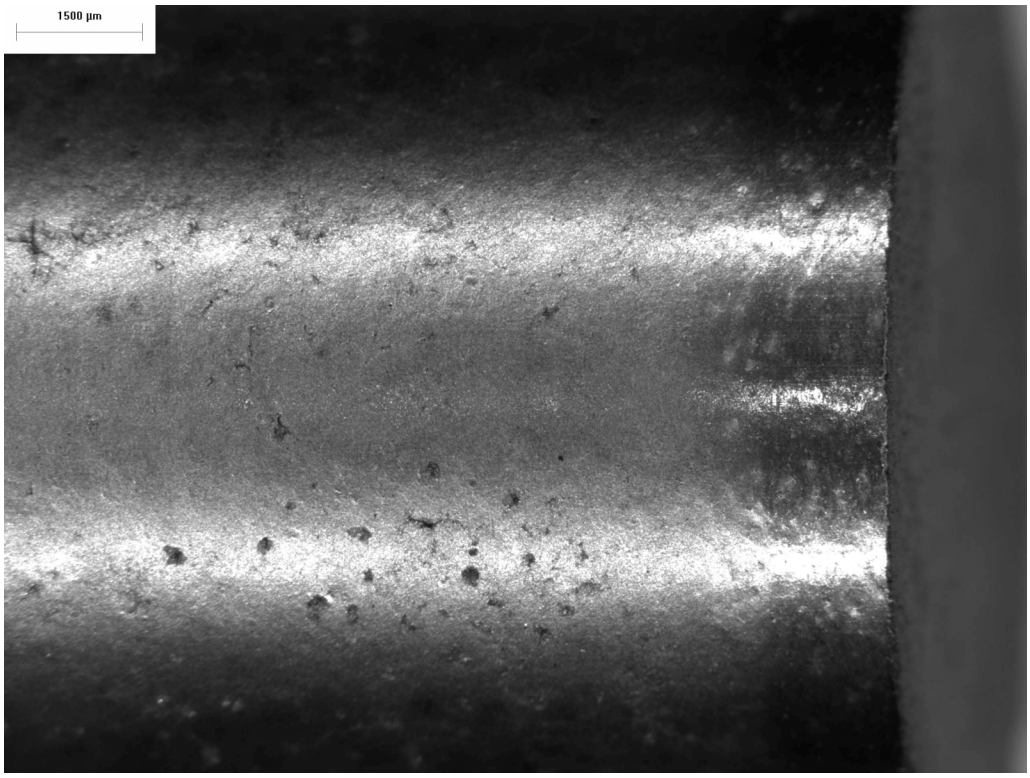


Figure A-6: Top of compact LEU01-47T-Z11 (32nd compact fabricated).

B. Anisotropy of pyrocarbon layers after compacting

To examine the change in pyrocarbon anisotropy during compact fabrication, particles were recovered after deconsolidation of the particles from the compact for defective OPyC analysis. After compacting, the anisotropy of the pyrocarbon layers was observed to increase. This increase is thought to occur during the heat treatment of the compacts at 1800°C for 1 hour. The diattenuation of the IPyC increased from 0.0047±0.0005 to 0.0071±0.0006 (1.0140±0.0014 to 1.0213±0.0017 in terms of effective BAFo). The diattenuation of the OPyC increased from 0.0044±0.0006 to 0.0100±0.0011 (1.0132±0.0017 to 1.0299±0.0034 in terms of effective BAFo). The following two DRF's contain the data for these measurements.

Data Report Form DRF-18A: Measurement of Pyrocarbon Anisotropy using the 2-MGEM - IPyC

Procedure:	AGR-CHAR-DAM-18 Rev. 1
Operator:	G. E. Jellison
Mount ID:	M06062002L
Sample ID:	LEU01-47T-G03
Sample Description:	Particles deconsolidated from AGR-1 variant 1 compact
Folder containing data:	\\mc-agr\AGR\2-MGEM\R06071901

Particle #	Grid Position	Diattenuation			Equivalent BAFo		
		Average	St. Dev.	Ave. Error	Average	St. Dev.	Ave. Error
1	4,3	0.0079	0.0036	0.0014	1.0237	0.0108	0.0042
2	4,6	0.0074	0.0030	0.0015	1.0222	0.0090	0.0045
3	4,7	0.0078	0.0027	0.0015	1.0234	0.0081	0.0045
4	5,4	0.0072	0.0027	0.0015	1.0216	0.0081	0.0045
5	5,6	0.0071	0.0026	0.0014	1.0213	0.0078	0.0042
6	5,8	0.0074	0.0025	0.0015	1.0222	0.0075	0.0045
7	6,3	0.0061	0.0024	0.0013	1.0183	0.0072	0.0039
8	6,4	0.0066	0.0025	0.0013	1.0198	0.0075	0.0039
9	6,6	0.0067	0.0027	0.0015	1.0201	0.0081	0.0045
10	6,8	0.0068	0.0026	0.0016	1.0204	0.0078	0.0048
Average		0.0071	0.0027	0.0015	1.0213	0.0082	0.0044

Mean of average BAFo per particle:	1.0213
Standard deviation of average BAFo per particle:	0.0017

Comments

G. E. Jellison — Operator

July 19, 2006 — Date

Data Report Form DRF-18B: Measurement of Pyrocarbon Anisotropy using the 2-MGEM - OPyC

Procedure:	AGR-CHAR-DAM-18 Rev. 1
Operator:	G. E. Jellison
Mount ID:	M06062002L
Sample ID:	LEU01-47T-G03
Sample Description:	Particles deconsolidated from AGR-1 variant 1 compact
Folder containing data:	\\mc-agr\AGR\2-MGEM\R06071901

Particle #	Grid Position	Diattenuation			Equivalent BAFo		
		Average	St. Dev.	Ave. Error	Average	St. Dev.	Ave. Error
1	4,3	0.0107	0.0030	0.0015	1.0321	0.0090	0.0045
2	4,6	0.0108	0.0028	0.0015	1.0324	0.0084	0.0045
3	4,7	0.0104	0.0033	0.0016	1.0312	0.0099	0.0048
4	5,4	0.0113	0.0031	0.0015	1.0339	0.0093	0.0045
5	5,6	0.0086	0.0026	0.0014	1.0258	0.0078	0.0042
6	5,8	0.0092	0.0031	0.0016	1.0276	0.0093	0.0048
7	6,3	0.0089	0.0031	0.0014	1.0267	0.0093	0.0042
8	6,4	0.0092	0.0030	0.0013	1.0276	0.0090	0.0039
9	6,6	0.0116	0.0039	0.0016	1.0348	0.0117	0.0048
10	6,8	0.0088	0.0029	0.0017	1.0264	0.0087	0.0051
Average		0.0100	0.0031	0.0015	1.0299	0.0092	0.0045

Mean of average BAFo per particle:	1.0299
Standard deviation of average BAFo per particle:	0.0034

Comments

G. E. Jellison — Operator

July 19, 2006 — Date