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Scientific Notebook No. 710: Radionuclide Transport (RT) Key Technical Issue - Continuation of Scientific Notebook No. 631 (05/03/2005 through 06/15/2005)

# LABORATORY NOTEBOOK

710

CNWRA/SwRI

NOTEBOOK NO. 710
ISSUED TO BRADLEY WERLING 210-522-6565
ON 5-2-2005 20____
DEPARTMENT DIV 20
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CNWRA
CONTROLLED
COPY 710

Radionuclide Transport in the Saturated Zone 20.06002.01.242 and the Unsaturated Zone 20.06002.01.232

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### Table of Contents

| Investigator | SIGNATURE | Initials | Page |
|---|---|---|---|
| BRADLEY WERLING | Bradley Werling | BAW | |
| Marla Roberts | Marla Roberts | MR | |

From Page No. 3 MAY 05 BAW

Initial Entry for Scientific Notebook 710

This notebook contains work for Radionuclide Transport (RT) in both the saturated zone and unsaturated zone (ISIs 20.06002.01.242 and 20.06002.01.232 respectively). RT is concerned with identification of key geochemical processes that may control radionuclide transport at Yucca Mountain. Radionuclide retardation is dependent on the hydrochemistry and mineralogy along the groundwater flow paths from the proposed repository. Typical activities associated with these investigations would include conducting laboratory batch sorption experiments, collecting field samples, and analyses of field samples.

Current experimental activities are focused on characterization of materials collected from the Yucca Mountain region and laboratory batch sorption experiments that incorporate these materials. Current alluvium characterization work will focus on XRF, XRD, and surface area analyses of sonic core samples. The objective for a sorption experiments is to determine the sorption capability (Kd or sorption coefficient) for a particular radionuclide, solid material, and solution typically over a range of pH values. Tasks typically include the following:

- Preparation of reference solutions.
- Cation (Div 01), inorganic carbon (CNWRA) and pH analyses (CNWRA) of reference solutions.
- Preparation of experimental solutions
- Liquid Scintillation Analyses (CNWRA) of experimental solutions.

Further details of these tasks are recorded in initial and in-process entries.

This scientific notebook (SN) is a continuation of SN 631. That notebook concludes with the sieve analysis of NC-EWDP-22PC Sonic Core Samples.

5-3-05

To Page No.

| Witnessed & Understood by me, | Date | Invented by | Date |
|---|---|---|---|
| | | Recorded by | |

From Page No. 3 MAY 05 CONT BW

**Continuation From SN 631 of Sieve Analysis of NC-EWDP-22PC Sonic Core Samples**

**Original Initial Entry**: 631/72-73

**Personnel initially involved**: Marla Roberts

**Objectives**
The sieving of the samples is conducted with three objectives:
- To characterized the sonic core samples by quantifying the amount of material in various mesh ranges
- To divide the sample into various mesh ranges in preparation for XRD, XRF, and surface area analyses.
- To create a subsample of material less than mesh 35 for potential use in sorption experiments

**Samples**
59 samples from NC-EWDP-22PC labeled as NC-EWDP-22PC-0305-"interval" from 631/67-68
- Initial collection at SMF 631/55-64
- Receipt at CNWRA 631/66

**Equipment**
- Sartoruis Scale - Model 3808MPS-IV20, serial # 39030006
- Ro-Tap machine - Model-B Spec # 34C63-5506 Combustion Engine

**Supplies**
- Sieve brushes
- Spatula
- Ziplock bags
- Various sizes of polystyrene bottles
- U.S.A Standard Test Sieve, ASTM E-11 Specification, from Fisher Scientific mesh #s 5, 10, 35, 100, 200, 325, and bottom pan
- Surface protector paper
- Weighing paper

**Procedure**

Each sample will be individually sieved for 15 minutes on the Ro-Tap machine using mesh #s 5, 10, and 35. This will divide the sample into four groups: greater than (>) mesh # 5, between mesh #s 5 and 10, between mesh #s 10 and 35, and less than (<) mesh # 35. A piece of surface protector paper will be placed on the scale and tared. The material from each mesh range will be individually placed on the scale and the mass will be recorded. The material from the three mesh ranges with the largest size material (>5, 5-10, and 10-35) was temporarily transferred into separate ziplock bags. These three bags were placed inside the original ziplock bag for that particular sample. In the future, the material from these three mesh ranges groupings may be recombined into one subsample. For now there are kept separate because aliquots from these specific mesh ranges may be sampled for analyses.

To Page No.

| Witnessed & Understood by me, | Date | Invented by | Date |
|---|---|---|---|
| | | Recorded by | |



From Page No. 3 MAY 2005 CONT BW

Aliquots for XRD and XRF analyses were collected from the less than (<) 35 material portion. The less than (<) 35 material was placed on a piece of surface protector paper. The sample was then quartered. Ideally, the XRF and XRD samples would come from different quarters, but this may not be possible base on the amount of material present. About 10 grams was removed from one quarter portion for XRD and about 15 grams was removed from a different quarter portion for XRF analyses. A polystyrene bottle was placed on the scale and tared. Once the appropriate amount of material was added, the mass was recorded. The polystyrene bottle was then appropriately labeled. The label prefix "22" represents the well ID - NC-EWDP-22PC. The label suffix represents the actual analyses performed: "F" for XRF and "D" for XRD. The middle number of the label represents the sample interval depth. A single number (depth) was selected within the original sample interval range that did not overlap with any other sample interval range.

After the XRF and XRD sampling was finished, the remaining portion of the less than (<) 35 material was transferred into a single polystyrene bottle. These bottles were labeled like the original samples (ie NC-EWDP-22PC-0305-462.0-462.9) with the suffix "<#35" added. More characterization of the less than (<) 35 portion is planned by further quantifying the amount of material in even smaller mesh ranges (100, 200, and 325). Also, surface area analyses of the less than (<) 35 portions is planned. These other characterizations would occur after this initial sieving process is completed. CNWRA staff want to send the XRF and XRD samples to the other labs for analyses as quickly as possible.

10 May 2005 MAP

To Page No.

| Witnessed & Understood by me, | Date | Invented by | Date |
|---|---|---|---|
| | | Recorded by | |

Project No.
Book No. TITLE

From Page No.

3 May 2005 MR
see initial entry: 710 / 2-3
*Sample prefixes: NC EWDP 22PC 0305

Sieve Analysis – Grain Distribution of Sonic Core Samples
NCEWDP22PC 0305

| ID | 3 May 05 MR ~~#4~~ Mass(g) >#5 | Mass(g) #5-#10 | Mass(g) #10-#35 | Mass(g) <#35-Pan |
|---|---|---|---|---|
| 653.1–654.5 | 188.6 | 95.3 | 151.2 | 105.2 |

4 May 05 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



Project No.
TITLE Book No.

From Page No.

3 May 2005 MR cont

Aliquot Removal from <#35 for XRD & XRF Analysis

| XRF Aliquot Sample ID | Mass(g) | XRD Aliquot Sample ID | 3 May 2005 MR ~~#4~~ Mass(g) |
|---|---|---|---|
| 22-653-F | 15.2 | 22-653-D | 10.2 |

4 May 05 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

Project No.
Book No. TITLE

From Page No. 4 May 05 MR
See initial entry: 710/2-3
*sample prefixes: NC-EWDP-22PC-0305

Sieve Analysis - Grain Distribution of Sonic Core Samples - NC-EWDP-22PC-0305

| ID | Mass(g) >#5 | Mass(g) #5-#10 | Mass(g) #10-#35 | Mass(g) <#35-Pan |
|---|---|---|---|---|
| 700.9-702.1 | 279.0 | 47.7 | 67.6 | 68.1 |
| 721.5-722.3 | 246.8 | 57.9 | 79.6 | 96.2 |
| 686.1-687.4 | 306.8 | 64.3 | 100.1 | 93.3 |
| 471.3-473.2 | 148.5 | 116.0 | 192.4 | 62.5 |

4 May 05 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



Project No.
TITLE Book No.

From Page No. 4 May 05 MR cont.

Aliquot Removal from <#35 for XRF + XRD Analysis

see initial entry 710/2-3

| XRF Aliquot Sample ID | Mass(g) | XRD Aliquot Sample ID | Mass(g) |
|---|---|---|---|
| 22-701-F | 15.2 | 22-701-D | 10.1 |
| 22-722-F | 15.0 | 22-722-D | 10.0 |
| 22-686-F | 15.0 | 22-686-D | 10.0 |
| 22-472-F | 15.1 | 22-472-D | 10.0 |

4 May 05 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

Project No.
Book No.
TITLE

From Page No. 4 May 05 MR cont.

see initial entry: 631/67-68

Recorded weights of oven dried samples-NCEWDP22PC

sample prefixes: NC-EWDP-22PC-0305
measured mass is without bag weight of ~ 12.7g

| ID | Mass (g) after oven dried | date dried |
|---|---|---|
| 747.4-748.8 | 458.7 | 3 May 05 |
| 614.1-615.5 | 526.2 | 3 May 05 |
| 471.3-473.2 | 520.6 | 3 May 05 |
| 4 May 05 MR 476.9-478.5 | 515.6 | 3 May 05 |
| 539.2-540.8 | 432.8 | 3 May 05 |
| 618.5-620.5 | 635.1 | 3 May 05 |
| 715.0-717.1 | 488.7 | 3 May 05 |
| 760.3-761.6 | 581.5 | 4 May 05 |
| 555.3-556.8 | 462.4 | 4 May 05 |

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



Project No.
Book No.
TITLE

From Page No. 5 May 05 MR

see initial entry: 710/2-3
*sample prefixes: NC-EWDP-22PC-0305

Sieve Analysis-Grain Distribution of Sonic Core Samples-NCEWDP22PC 0305

| ID | Mass (g) >#5 | Mass (g) #5-#10 | Mass (g) #10-#35 | Mass (g) <#35 |
|---|---|---|---|---|
| 760.3-761.6 | 316.4 | 46.3 | 114.1 | 103.5 |
| 555.3-556.8 | 129.7 | 92.4 | 174.9 | 63.8 |
| 747.4-748.8 | 180.5 | 89.4 | 119.0 | 65.1 |
| 618.5-620.5 | 234.7 | 117.6 | 188.8 | 93.7 |
| 715.0-717.1 | 297.3 | 45.3 | 67.2 | 79.4 |
| 740.5-742.5 | 711.6 | 57.7 | 95.5 | 102.1 |
| 614.1-615.5 | 156.5 | 113.5 | 148.0 | 99.0 |
| 5 May 05 MR ~~35~~ 476.9-478.5 | 257.3 | 74.0 | 106.3 | 78.1 |
| 539.2-540.8 | 188.3 | 78.0 | 110.2 | 116.3 |

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

Project No.
Book No. TITLE

From Page No. 5 May 05 MR

See initial entry: 710/2-3

Aliquot Removal from <#35 for XRF & XRD Analysis

| XRF Aliquot | | XRD Aliquot | |
|---|---|---|---|
| Sample ID | Mass(g) | Sample ID | Mass(g) |
| 22-760-F | 15.0 | 22-760-D | 10.0 |
| 22-555-F | 15.2 | 22-555-D | 10.0 |
| 22-748-F | 15.1 | 22-748-D | 10.0 |
| 22-619-F | 15.0 | 22-619-D | 10.2 |
| 22-716-F | 14.9 | 22-716-D | 10.1 |
| 22-741-F | 15.0 | 22-741-D | 10.0 |
| 22-614-F | 14.9 | 22-614-D | 10.1 |
| 22477-F | 15.1 | 22477-D | 10.0 |
| 22-540-F | 15.1 | 22-540-D | 10.1 |

Recorded weights of oven dried samples: NCEWDP22PC 0305

See initial entry: 631/67-68; ID prefix: NCEWDP22PC0305
sample weight is without weight of bag: 12.7g

| Sample ID | Mass(g) after oven dried | date dried |
|---|---|---|
| 740.5-742.0 | 568.3 | 5 May 2005 |

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



Project No.
TITLE Book No.

From Page No. 6 May ~~205~~ 6 May 05 2005 MR

See initial entry 631/72-73
* re-weighed <#35 for 694.3-695.6, see below

Aliquot Removal from <#35 for XRF & XRD

| XRF Aliquot | | XRD Aliquot | |
|---|---|---|---|
| Sample ID | Mass(g) | Sample ID | Mass(g) |
| 22-~~6946~~ 695-F (12 May 05) | 15.2 | 22-~~6946~~ 695-D (12 May 05) | 10.2 |

Mass(g) <#35 - Pan
60.9

Initial recorded mass (g) for 694.3-695.6 <#35 (631/73) was incorrect. The value recorded was the mass (g) of the empty polystyrene vial. Error was caught when sample masses (g) were input into the electronic database. The mass (g) of the <#35 portion was measured and recorded on 710/11. Masses (g) for the other 3 mesh ranges (>#5, #5-#10, and #10-#35) for this sample were reweighed and determined to be initially recorded accurately on 631/73.

Not all 59 samples from, NC-EWDP-22PC-0305 (631/ 67-68), were dried. Only samples showing visible condensation on the interior of the Ziploc bags were oven dried. For samples that required drying, the sieving analysis was performed after the samples were dried.

12 May 2005 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

From Page No.___ 10 May 2005 [illegible]

Creation of three known standards to include in group of XRD samples

Three known standards are included in the group of samples being sent out for XRD analysis to determine the validity of the lab results. The first standard is 99a Sodium Feldspar and the other two are mixes of various minerals explained below.

Mix 1 and Mix 2 labeled 22-769-D and 22-773-D respectivly, consist of four separate mineral fractions. These two standards consist of Quartz (W510 * 60/100 * UC * RC * 5-10-05 RFe * HL, 365/19), Clinoptilolite (CDV * 200/325 * UC * WA * RL * HL * RFe (420/63), Montmorillonite (SAz-1) (Sity of Missouri-Columbia, Source Clay Minerals Repository, Arizona), Calcite 5-10-05 (Sa 309/146).
The weights of each mineral fraction contained in each of the two mixes can be found on 7/10/13

Weighing of standard material fractions (ID's 22-769-D and 22-773-D

The material fractions of the three standards included in the set of XRD samples to be sent off for analysis with the 2005 EWDP-22PC samples were weighed on the Mettler Toledo PR 5002 scale (SN 1122142730). Each mineral fraction was weighed individually then combined and stored in a 15 dr plastic container

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



From Page No.___ 10 May 2005 cont. [illegible]

Fraction weights of two mix standards for XRD analysis, ID's 22-769-D, 22-773-D

| Mineral | Mix # 1 ID: 22-769-D Fraction Weight (g) | Mix # 2 ID: 22-773-D Fraction Weight (g) |
|---|---|---|
| Quartz | 4.00 | 6.00 |
| Montmorillonite | 2.00 | 1.00 |
| Clinoptilolite | 2.00 | 4.00 |
| Calcite 5-10-05 | 1.00 | 0.50 |
| Total | 9.00 | 11.50 |

Table of XRD Standard Sample Original label, New label and weight

| Original ID | New ID For XRD analysis | Sample weight (g) |
|---|---|---|
| 99a Sodium Feldspar | 22-764-D | 5.00 |
| Mix 1 (reference 7/10/12) | 22-769-D | 9.00 |
| Mix 2 (reference 7/10/12) | 22-773-D | 11.50 |

5/11/05 [illegible]

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

From Page No.____ 11 May 2005

Creation of 3 known standards to include in XRF samples

These known standards are created and included in the 59 sieve samples being sent out for XRF analysis ~~CCP~~ 5/11/05
(EWDP-22PC samples).
Each standard is ~10 g.
NBS = National Bureau of Standards
~~BGM~~ 5/11/05

| | | New ID |
|---|---|---|
| NBS 70a | = Potassium Feldspar | 22-765-F |
| NBS 99a | = Sodium Feldspar | 22-768-F |
| NBS 278. | = Obsidian Rock | 22-774-F |

12 May 2005 MR

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



From Page No.____ 12 May 2005 MR

**Surface Area Analysis of NC-EWDP-22PC-0305 Sonic Core Samples**

**Personnel initially involved**: Marla Roberts

**Objectives**: Determine surface area of 59 NC-EWDP-22PC-0305 sonic core samples.

**Samples**: 59 samples from NC-EWDP-22PC-0305 labeled as NC-EWDP-22PC-0305-"interval" <#35 from 631/72-95 and 710/2-11. Only <#35 was used.

**Equipment**: Surface Area Analyzer, Coulter, SA 3100
Mettler AE240 Balance, Serial Number 101237
Okidata, Microline 390 Plus, 24 Pin Printer

**Supplies**: Liquid Nitrogen
Helium-Zero Grade
Compressed Nitrogen-UHB
Spatulas
Loading Funnel
Weighing Paper
3cc to 9cc Glass Sample Tube
Glass Stirrers
Tube Caps
NIST 1899 Silicon Nitride Surface Area ($10m^2/g$)
Lubricant DOW Corning High Vacuum Grease

16 May 05 MR
See initial entry 710/18-19

**Basic Outline Procedure**:

Prior to using the Surface Area Analyzer, Coulter, SA 3100 the O-rings are checked for integrity. The O-rings are replaced if brittle or cracked. Otherwise, O-rings are lubricated. After checking the machinery, the gas cylinders containing Helium and Nitrogen are turned so the valve is fully opened and then turned back a quarter turn. The surface area analyzer is challenged using a known surface area standard, NIST 1899 Silicon Nitride Surface Area ($10m^2/g$).

Three samples can be analyzed at a time in the surface area analyzer.

Each tube with glass stirrer and cap is weighed and the mass (g) is recorded. Approximately 1.7 – 2.0 g of sample is removed from <#35. The sample aliquot mass (g) is recorded. The aliquot is placed in tube using a loading funnel. The cap is replaced on tube and taken to the surface area analyzer. Before placing the sample in the analyzer sample information must be entered into the machine software on the 'Sample Information' screen. The sample information needed will be: the sample ID, operator, and the sample weight. Repeat three times to run surface area analyzer at capacity.

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

From Page No. 12 May 2005 MR cont.

To insert samples into surface area analyzer loosen the knurled nut on the outgas port. Remove the cap from sample tube, then insert the tube onto the outgas port until it stops against the manifold. Tighten the knurled nut until finger tight.

Now go to 'Outgas' screen. Press 'Outgas Temperature' and 'Outgas Time' to change the value displayed. The value for Outgas Temperature = 350 and Outgas Time = 720 minutes. Now press 'Start.'

Once the analysis is complete, remove the sample and promptly replace cap for sample tube. The tube is reweighed and the mass (g) is recorded. Outgas weight is found and recorded. The outgas weight is the mass (g) after outgasing minus the mass (g) of the tube with glass stirrer and cap recorded earlier.

Individual outgased samples are reloaded into surface area analyzer. On the 'Sample Information' screen change sample weight value to the outgas weight. Liquid Nitrogen is added to dewar and loaded onto the surface area analyzer. The analysis proceeds automatically.

At the completion of the analysis the results are displayed on the screen for about 2 minutes. Prompts will alert operator to remove the dewar and the sample. A paper report is printed. Additional outgased samples are placed in surface area analyzer one at a time.

16 May 05 MR
See initial entry 710/18-19

*Sample prefixes: NG-EWDP-22PC-0305
"ID" is same identification number used in the XRF, XRD analysis 631/70-71.

| interval | ID | Tube, Stirrer + Cap Mass (g) | Aliquot Mass (g) |
|---|---|---|---|
| 555.3-556.8 | 555 | 29.3265 | 12 May 05 MR 2.0048 |
| 640.3-641.4 | 640 | 29.42439 | 1.8103 → Aliquot taken and discarded 1.75701 |
| 694.3-695.6 | 695 | 29.8203 | 16 May 05 MR 1.7227 |

16 May 05 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by



From Page No. 16 May 2005 MR

*initial entry 710/15-16 was revised. The new initial entry can be found on 710/18-19. In addition the samples recorded on 710/16 have also been revised and re-entered 710/20 to fit into new table format, and correctly identify sample IDs.

16 May 05 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by

From Page No.___ 16 May 05 MR cont.

## Surface Area Analyses of NC-EWDP-22PC-0305 less than (<) Mesh # 35 Sonic Core Samples

**Personnel initially involved**: Marla Roberts and Jon Brown

**Objectives:** To characterize alluvium in the Forty Mile Wash area of the Yucca Mountain region by determining the surface area of a particular grain size range (< mesh#35) from sonic core samples collected from NC-EWDP-22PC.

**Samples:** The 59 samples analyzed were the less than (<) mesh # 35 subsamples derived from the sonic core collected from the May 2005 sampling event described in 631/55-64. The samples that were analyzed were labeled "NC-EWDP-22PC-0305-XXX,<#35 mesh" where XXX represents the specific depth interval (ie 471.3-473.2) and are found in 631/72-95 and 710/2-11. The <#35 mesh samples were also analyzed for XRF, LOI, ICP-MS, and XRD analyses.

**Equipment:** Coulter Surface Area Analyzer model SA 3100, serial number 46020
Mettler Electronic Balance model AE240, serial number 101237 BW 5-19-05

**Reagents:** NIST silicon nitride surface area standard 1899 ($10 m^2/g$)
Helium - Zero grade - 99.995%
Nitrogen - UHP grade - 99.999%
Liquid nitrogen
DOW Corning high vacuum grease
Type I water

**Supplies:** Loading funnel
3cc to 9cc glass surface area sample tubes with glass inserts and tube caps
Weighing paper
Spatulas

**Procedure**

Prior to using the surface area analyzer, the O-rings were checked for integrity and replaced with new ones if brittle or cracked. The o-rings were lubricated with high vacuum grease.

During the initial stages of analyses and at the conclusion, the surface area analyzer was challenged with a standard of known surface area ($10 m^2/g$) that was expected to have a surface area similar to the samples. The surface area analyzer can outgas three different samples at a time but can only perform the surface area determination one sample at a time.

The mass of the empty glass sample tube with glass stirrer and cap was recorded. An appropriate amount (between 1.7 to 2.0 g) of sample was added to a tared weigh paper and the mass recorded. The aliquot was transferred into a glass sample tube with a loading funnel on top. The loading funnel was removed and replaced with a tube cap. This process was repeated for two other samples since three samples can be outgassed at one time.

The following sample information was entered into the surface area analyzer data acquisition software prior to outgassing: sample ID, operator, and sample mass. The software limits to sample ID to six characters so another sample ID was created for each sample. This new ID





From Page No.___ 16 May 05 MR cont.

was recorded (along with the original sample ID) when the initial aliquot mass was recorded. This new sample ID had a prefix "22-" on all of the samples to indicate that the samples came from the NC-EWDP-22PC well. The last three characters were unique numbers that represents the sample interval depth. A single number (depth) was selected within the original sample interval range that did not overlap with any other sample interval range.

The tube caps were removed and the samples were inserted into the surface area analyzer for outgassing under the following conditions: outgas temperature of 350°C and outgas time of 720 minutes. Once the outgas process was complete, the samples could be removed. Each sample tube was promptly recapped and the "total mass" after outgassing is recorded. The sample mass after the outgassing process, referred to as the "outgas sample mass", was calculated by subtracting the mass of the empty sample tube with glass stirrer and cap from the "total mass".

The surface area analyses proceeded one sample at a time. An outgassed sample was uncapped and reloaded into the analyzer. The sample mass information in the data acquisition software was updated with the "outgas sample mass". Liquid nitrogen was added to the analyzer and the analysis automatically starts. At the completion of the analyses a hardcopy of the results was generated and placed in the scientific notebook. The process was repeated for the remaining two outgassed samples.

After the analyses was complete, the sample aliquot was discarded. The sample glass tubes, inserts and caps were cleaned with type I water and oven dried. The whole process was repeated for another set of three samples.

*This is a revised initial entry. The original initial entry is 710/15-16

16 May 05 MR

To Page No._____

From Page No. 16 May 05 MR cont

*see initial entry: 710/18-19

*Sample prefix: NC-EWDP-22PC-0305 ①

Surface Area Analyses of NCEWDP22PC0305 <#35 Sonic Core Samples.

Initial, before outgassing - original

| Sample ID① | SAA ID# Sample | ~~Mag~~ Outgass (g) of tube, cap+insert (mass 05 MR) | Aliquot mass (g) |
|---|---|---|---|
| 555.3-556.8 <#35 | 22-555 | 29.3265 | 2.0481 |
| 640.3-641.4 <#35 | 22-640 | 29.42439 | 1.75701 |
| 694.3-695.6 <#35 | 22-695 | 29.8203 | 1.7227 |

Aliquot taken and discarded 1.8103

#SAA = Surface Area Analyses

16 May 05 MR



Witnessed & Understood by me, Date Invented by Date Recorded by



From Page No. 16 May 05 MR cont.

*See initial entry 710/18-19

*** calculation

Surface Area Analyses of NCEWDP22PC0305 < #35 Sonic Core Samples

*sample prefix: NCEWDP22PC0305 ①

After outgassing

| Sample ID① | SAA Sample# ID | Total Mass(g) | outgass Sample mass(g)*** |
|---|---|---|---|
| 555.3-556.8 <#35 | 22-555 | 31.1851 | 1.8586 |
| 640.3-641.4 <#35 | 22-640 | 31.0499 | 1.62551 |
| 694.3-695.6 <#35 | 22-695 | 31.4246 | 1.6043 |

#SAA = Surface Area Analyses

16 May 05 MR



Witnessed & Understood by me, Date Invented by Date Recorded by

From Page No.____ 17 May 2005 MR 17 May 05 MR
SAA printout - SAA Sample ID 22-~~555~~ 555

SA256
Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-555 | Start Date | 02/15/04 |
| Customer | CNWRA | Start Time | 04:21:08 |
| Operator | MR | Elapsed Time | 54 min |
| Sample Wt | 1.8586 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 21.153 sq.m/g |
| Micropore Surface Area | 8.657 sq.m/g |
| Micropore Volume | 0.00371 ml/g |
| Correlation Coefficient | 0.99933 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-555 | Start Date | 02/15/04 |
| Customer | CNWRA | Start Time | 04:21:08 |
| Operator | MR | Elapsed Time | 54 min |
| Sample Wt | 1.8586 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 21.153 sq.m/g |
| Total Surface Area | 29.810 sq.m/g |
| Micropore Surface Area | 8.657 sq.m/g |
| Micropore Volume | 0.00371 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 13.6734 |
| Intercept | 2.39875 |
| Correlation Coefficient | 0.99933 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3523 | 7.181 |
| 0.3679 | 7.420 |
| 0.3802 | 7.602 |
| 0.3939 | 7.798 |
| 0.4082 | 8.000 |
| 0.4217 | 8.188 |
| 0.4358 | 8.378 |

Sample ID:
NCEWDP22PC 0305
555.3-556.8 <#35
Mass (g) before outgassing:
710/20
Mass (g) after outgassing
710/21
19 May 05 MR

Witness ____ Page No.____





From Page No.____ 17 May 05 MR cont. 17 May 05 MR
SAA printout cont. - SAA Sample ID 22-~~555~~ 555

SA256

| | |
|---|---|
| 0.4610 | 8.697 |
| 0.4872 | 9.028 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-555 | Start Date | 02/15/04 |
| Customer | CNWRA | Start Time | 04:21:08 |
| Operator | MR | Elapsed Time | 54 min |
| Sample Wt | 1.8586 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0181 |
| Intercept | 0.0037 |
| Correlation Coefficient | 0.99999 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 734.36 |
| 0.0001 | 0.240 | 0.038 | 734.41 |
| 0.0001 | 0.479 | 0.074 | 734.41 |
| 0.0001 | 0.756 | 0.109 | 734.54 |
| 0.0003 | 1.064 | 0.206 | 734.59 |
| 0.0003 | 1.366 | 0.212 | 734.77 |
| 0.0004 | 1.752 | 0.321 | 734.77 |
| 0.0005 | 2.090 | 0.364 | 734.95 |
| 0.0008 | 2.567 | 0.566 | 735.02 |
| 0.0011 | 2.942 | 0.788 | 734.92 |
| 0.0015 | 3.337 | 1.130 | 735.06 |
| 0.0024 | 3.750 | 1.757 | 735.11 |
| 0.0036 | 4.183 | 2.631 | 735.20 |
| 0.0052 | 4.633 | 3.852 | 735.27 |
| 0.0078 | 5.096 | 5.768 | 735.28 |
| 0.0107 | 5.416 | 7.873 | 735.41 |
| 0.0149 | 5.713 | 10.993 | 735.46 |
| 0.0209 | 5.983 | 15.337 | 735.49 |
| 0.0251 | 6.133 | 18.451 | 735.48 |
| 0.0300 | 6.277 | 22.101 | 735.56 |
| 0.0357 | 6.417 | 26.263 | 735.60 |
| 0.0418 | 6.544 | 30.752 | 735.61 |
| 0.0480 | 6.665 | 35.321 | 735.59 |
| 0.0545 | 6.781 | 40.092 | 735.67 |
| 0.0588 | 6.857 | 43.247 | 735.67 |
| 0.0636 | 6.936 | 46.755 | 735.61 |
| 0.0708 | 7.044 | 52.070 | 735.75 |
| 0.0806 | 7.181 | 59.319 | 735.63 |
| 0.1001 | 7.420 | 73.622 | 735.59 |
| 0.1165 | 7.602 | 85.692 | 735.63 |
| 0.1356 | 7.798 | 99.709 | 735.56 |
| 0.1564 | 8.000 | 115.040 | 735.62 |
| 0.1768 | 8.188 | 130.034 | 735.55 |

Witnessed & Recorded by

Project No.
Book No. TITLE

From Page No. 17 May 05 MR - cont 19 May 05 MR
SAA printout - SAA Sample ID 22-~~655~~ 555

SA256

| | | | |
|---|---|---|---|
| 0.1983 | 8.378 | 145.886 | 735.55 |
| 0.2375 | 8.697 | 174.686 | 735.49 |
| 0.2784 | 9.028 | 204.778 | 735.50 |
| 0.3162 | 9.318 | 232.564 | 735.39 |
| 0.3598 | 9.659 | 264.611 | 735.42 |
| 0.3982 | 9.950 | 292.782 | 735.32 |
| 0.4415 | 10.279 | 324.625 | 735.22 |

17 May 05 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



Project No.
TITLE Book No.

From Page No. 17 May 05 MR - cont.
SAA printout - SAA Sample ID : 22-640

SA257

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-640 | Start Date | 02/15/04 |
| Customer | CNWRA | Start Time | 06:06:54 |
| Operator | MR | Elapsed Time | 52 min |
| Sample Wt | 1.62551 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 17.020 sq.m/g |
| Micropore Surface Area | 6.684 sq.m/g |
| Micropore Volume | 0.00287 ml/g |
| Correlation Coefficient | 0.99956 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-640 | Start Date | 02/15/04 |
| Customer | CNWRA | Start Time | 06:06:54 |
| Operator | MR | Elapsed Time | 52 min |
| Sample Wt | 1.62551 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 17.020 sq.m/g |
| Total Surface Area | 23.704 sq.m/g |
| Micropore Surface Area | 6.684 sq.m/g |
| Micropore Volume | 0.00287 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 11.0018 |
| Intercept | 1.85675 |
| Correlation Coefficient | 0.99956 |

19 May 05 MR

Sample ID:
NCEWDP22PC0305
640.3 – 641.4 < #35

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3522 | 5.710 |
| 0.3691 | 5.912 |
| 0.3800 | 6.038 |
| 0.3938 | 6.199 |
| 0.4084 | 6.363 |
| 0.4229 | 6.523 |
| 0.4357 | 6.661 |

Mass(g) before outgassing
710/20
Mass(g) after outgassing
710/21

Page 1

Witnesse | Recorded by

From Page No. 17 May 05 MR cont.

SAA printout - SAA Sample ID: 22-640

SA257

| | |
|---|---|
| 0.4607 | 6.925 |
| 0.4875 | 7.198 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-640 | Start Date | 02/15/04 |
| Customer | CNWRA | Start Time | 06:06:54 |
| Operator | MR | Elapsed Time | 52 min |
| Sample Wt | 1.62551 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0170 |
| Intercept | 0.0029 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 748.11 |
| 0.0000 | 0.272 | 0.034 | 748.08 |
| 0.0001 | 0.544 | 0.066 | 747.97 |
| 0.0001 | 0.863 | 0.098 | 747.95 |
| 0.0003 | 1.217 | 0.202 | 747.86 |
| 0.0004 | 1.561 | 0.263 | 747.84 |
| 0.0007 | 2.000 | 0.543 | 747.91 |
| 0.0012 | 2.380 | 0.886 | 747.84 |
| 0.0020 | 2.774 | 1.502 | 747.81 |
| 0.0033 | 3.183 | 2.456 | 747.87 |
| 0.0052 | 3.606 | 3.863 | 747.84 |
| 0.0081 | 4.036 | 6.079 | 747.84 |
| 0.0124 | 4.378 | 9.306 | 747.99 |
| 0.0193 | 4.673 | 14.413 | 747.94 |
| 0.0281 | 4.919 | 21.016 | 748.00 |
| 0.0339 | 5.044 | 25.339 | 747.97 |
| 0.0403 | 5.165 | 30.181 | 748.09 |
| 0.0479 | 5.284 | 35.821 | 748.02 |
| 0.0551 | 5.395 | 41.236 | 748.02 |
| 0.0600 | 5.462 | 44.900 | 748.07 |
| 0.0655 | 5.535 | 48.985 | 748.11 |
| 0.0705 | 5.598 | 52.755 | 748.14 |
| 0.0806 | 5.710 | 60.316 | 748.10 |
| 0.1017 | 5.912 | 76.064 | 748.02 |
| 0.1161 | 6.038 | 86.872 | 748.04 |
| 0.1354 | 6.199 | 101.297 | 748.07 |
| 0.1567 | 6.363 | 117.200 | 748.00 |
| 0.1785 | 6.523 | 133.540 | 747.96 |
| 0.1982 | 6.661 | 148.204 | 747.91 |
| 0.2371 | 6.925 | 177.300 | 747.87 |
| 0.2789 | 7.198 | 208.575 | 747.87 |
| 0.3183 | 7.458 | 238.000 | 747.81 |
| 0.3583 | 7.722 | 267.938 | 747.73 |



Witnesse

Recorded by

No.



From Page No. 17 May 05 MR cont.

SAA printout - SAA Sample ID: 22-640

SA257

| | | | |
|---|---|---|---|
| 0.3990 | 7.994 | 298.319 | 747.73 |
| 0.4406 | 8.279 | 329.439 | 747.73 |

17 May 05 MR

To Page No.

Witnessed & Understood by me, Date Invented by Date

Recorded by

From Page No. 17 May 05 MR cont.
SAA printout - SAA Sample ID: 22-695

SA258

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-695 | Start Date | 02/15/04 |
| Customer | CNWRA | Start Time | 07:23:55 |
| Operator | MR | Elapsed Time | 48 min |
| Sample Wt | 1.6043 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 14.120 sq.m/g |
| Micropore Surface Area | 5.333 sq.m/g |
| Micropore Volume | 0.00229 ml/g |
| Correlation Coefficient | 0.99956 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-695 | Start Date | 02/15/04 |
| Customer | CNWRA | Start Time | 07:23:55 |
| Operator | MR | Elapsed Time | 48 min |
| Sample Wt | 1.6043 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 14.120 sq.m/g |
| Total Surface Area | 19.453 sq.m/g |
| Micropore Surface Area | 5.333 sq.m/g |
| Micropore Volume | 0.00229 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 9.1275 |
| Intercept | 1.48217 |
| Correlation Coefficient | 0.99956 |

19 May 05 MR
- Sample ID: NLEWDP22PC0305 694.3-695.6 L#35

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3523 | 4.678 |
| 0.3687 | 4.843 |
| 0.3801 | 4.956 |
| 0.3949 | 5.095 |
| 0.4092 | 5.228 |
| 0.4223 | 5.347 |
| 0.4360 | 5.471 |

- Mass (g) before outgassing 710/20
- Mass (g) after outgassing 710/21





From Page No. 17 May 05 MR cont.
SAA printout - SAA Sample ID: 22-695

SA258

| | |
|---|---|
| 0.4613 | 5.691 |
| 0.4877 | 5.916 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-695 | Start Date | 02/15/04 |
| Customer | CNWRA | Start Time | 07:23:55 |
| Operator | MR | Elapsed Time | 48 min |
| Sample Wt | 1.6043 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0164 |
| Intercept | 0.0026 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 748.07 |
| 0.0000 | 0.279 | 0.032 | 748.16 |
| 0.0001 | 0.555 | 0.062 | 748.17 |
| 0.0001 | 0.876 | 0.108 | 748.16 |
| 0.0003 | 1.235 | 0.254 | 748.24 |
| 0.0005 | 1.581 | 0.411 | 748.23 |
| 0.0011 | 1.941 | 0.789 | 748.24 |
| 0.0019 | 2.319 | 1.455 | 748.30 |
| 0.0034 | 2.708 | 2.562 | 748.29 |
| 0.0058 | 3.105 | 4.324 | 748.32 |
| 0.0101 | 3.493 | 7.543 | 748.37 |
| 0.0173 | 3.792 | 12.947 | 748.35 |
| 0.0275 | 4.027 | 20.545 | 748.42 |
| 0.0337 | 4.137 | 25.247 | 748.47 |
| 0.0408 | 4.242 | 30.538 | 748.48 |
| 0.0490 | 4.351 | 36.676 | 748.50 |
| 0.0572 | 4.447 | 42.805 | 748.44 |
| 0.0625 | 4.504 | 46.754 | 748.44 |
| 0.0698 | 4.579 | 52.243 | 748.44 |
| 0.0807 | 4.678 | 60.409 | 748.42 |
| 0.1011 | 4.843 | 75.661 | 748.39 |
| 0.1164 | 4.956 | 87.090 | 748.37 |
| 0.1371 | 5.095 | 102.598 | 748.32 |
| 0.1579 | 5.228 | 118.183 | 748.27 |
| 0.1776 | 5.347 | 132.874 | 748.27 |
| 0.1986 | 5.471 | 148.581 | 748.21 |
| 0.2380 | 5.691 | 178.049 | 748.17 |
| 0.2792 | 5.916 | 208.853 | 748.16 |
| 0.3180 | 6.127 | 237.858 | 748.07 |
| 0.3586 | 6.351 | 268.260 | 748.12 |
| 0.3992 | 6.569 | 298.590 | 748.02 |
| 0.4416 | 6.798 | 330.361 | 748.05 |

From Page No. 17 May 05 MR cont.

*see initial entry: 710/18-19

*sample prefixes: NC-EWDP-22PC-0305 ①

Surface Area Analyses of NCEWDP-22PC-0305 <#35 Sonic Core Samples.

Initial, before outgassing / original

| Sample ID ① | SAA Sample# ID | Mass(g) of tube, cap + insert | Aliquot Mass (g) |
|---|---|---|---|
| 614.1-615.5, <#35 | 22-614 | 28.7584 | 1.8848 |
| 647.1-648.4, <#35 | 22-647 | 29.0327 | 1.7094 |
| NIST-1899 Silicon nitride | 17May05 MR ~~1899-S~~ 1899S | 29.4326 | 17May05 MR ~~1.7349~~ 1.1455 |

~~*sample aliquot mass (g) is without weight of weighing paper ~ 0.2481~~ 18 May 05 MR

# SAA = Surface Area Analyses.

18 May 05 MR

To Page No.

Witnessed & Understood by me, Date Invented by Date Recorded by



From Page No. 18 May 05 MR

See initial entry 710/18-19

Sample ID prefix: NCEWDP-22PC-0305 ①

Surface Area Analysis of NCEWDP22PC0305 <#35 Sonic Core Samples after outgassing

After outgassing

| Sample ID ① | SAA Sample# ID | Total Mass (g) | Outgassed Sample Mass (g)* |
|---|---|---|---|
| 614.1-615.5 <#35 | 22-614 | 30.4984 | 1.7400 |
| 647.1-648.4 <#35 | 22-647 | 30.6302 | 1.5975 |
| NIST-1899 Silicon Nitride | 1899S | 30.5790 | 1.1444 |

~~*Calculation = total mass - mass of tube, cap + insert, 710/30~~ ~~- total mass is the mass (g) of the tube, cap + insert plus the sample after outgassing.~~ 18 May 05 MR

# SAA = Surface Area Analyses

18 May 05 MR

To Page No.

Witnessed & Understood by me, Date Invented by Date Recorded by

From Page No.___ 19 May 05 MR

SA259
Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-614 | Start Date | 02/17/04 |
| Customer | CNWRA | Start Time | 02:51:58 |
| Operator | MR | Elapsed Time | 47 min |
| Sample Wt | 1.74 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 16.785 sq.m/g |
| Micropore Surface Area | 7.259 sq.m/g |
| Micropore Volume | 0.00313 ml/g |
| Correlation Coefficient | 0.99933 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-614 | Start Date | 02/17/04 |
| Customer | CNWRA | Start Time | 02:51:58 |
| Operator | MR | Elapsed Time | 47 min |
| Sample Wt | 1.74 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 16.785 sq.m/g |
| Total Surface Area | 24.044 sq.m/g |
| Micropore Surface Area | 7.259 sq.m/g |
| Micropore Volume | 0.00313 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 10.8500 |
| Intercept | 2.02302 |
| Correlation Coefficient | 0.99933 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3522 | 5.816 |
| 0.3682 | 6.011 |
| 0.3795 | 6.146 |
| 0.3946 | 6.317 |
| 0.4087 | 6.476 |
| 0.4219 | 6.617 |
| 0.4360 | 6.765 |

Page 1

-Sample ID:
NE-EWDP-22PC-0305
614.1-615.5 L#35
-Surface Area Analyses ID:
22-614
-Mass before outgassing
710/30
-Mass (g) after outgassing
710/31
19 May 05 MR

To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



From Page No.___ 19 May 05 MR cont.

| | |
|---|---|
| 0.4603 | 7.016 |
| 0.4865 | 7.276 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-614 | Start Date | 02/17/04 |
| Customer | CNWRA | Start Time | 02:51:58 |
| Operator | MR | Elapsed Time | 47 min |
| Sample Wt | 1.74 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0170 |
| Intercept | 0.0027 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 744.13 |
| 0.0000 | 0.254 | 0.035 | 744.05 |
| 0.0001 | 0.511 | 0.063 | 744.19 |
| 0.0001 | 0.807 | 0.102 | 744.12 |
| 0.0003 | 1.137 | 0.215 | 744.16 |
| 0.0003 | 1.458 | 0.258 | 744.18 |
| 0.0006 | 1.869 | 0.446 | 744.25 |
| 0.0009 | 2.228 | 0.639 | 744.27 |
| 0.0014 | 2.601 | 1.039 | 744.37 |
| 0.0022 | 2.995 | 1.667 | 744.40 |
| 0.0036 | 3.402 | 2.664 | 744.31 |
| 0.0055 | 3.824 | 4.119 | 744.43 |
| 0.0088 | 4.250 | 6.552 | 744.44 |
| 0.0134 | 4.569 | 10.008 | 744.42 |
| 0.0204 | 4.843 | 15.195 | 744.48 |
| 0.0256 | 4.986 | 19.028 | 744.43 |
| 0.0314 | 5.122 | 23.339 | 744.44 |
| 0.0382 | 5.250 | 28.416 | 744.47 |
| 0.0452 | 5.367 | 33.662 | 744.67 |
| 0.0525 | 5.473 | 39.111 | 744.56 |
| 0.0574 | 5.541 | 42.727 | 744.59 |
| 0.0628 | 5.613 | 46.774 | 744.60 |
| 0.0702 | 5.703 | 52.272 | 744.65 |
| 0.0806 | 5.816 | 60.036 | 744.71 |
| 0.1005 | 6.011 | 74.829 | 744.76 |
| 0.1155 | 6.146 | 86.036 | 744.64 |
| 0.1366 | 6.317 | 101.708 | 744.70 |
| 0.1573 | 6.476 | 117.116 | 744.68 |
| 0.1771 | 6.617 | 131.856 | 744.71 |
| 0.1986 | 6.765 | 147.920 | 744.72 |
| 0.2364 | 7.016 | 176.080 | 744.69 |
| 0.2773 | 7.276 | 206.484 | 744.68 |
| 0.3188 | 7.538 | 237.393 | 744.69 |
| 0.3580 | 7.787 | 266.549 | 744.65 |
| 0.3991 | 8.046 | 297.211 | 744.63 |
| 0.4410 | 8.312 | 328.373 | 744.59 |

To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

From Page No.____ 19 May 05 MR cont.
SampleID: NCEWDP22PG-0305 647.1-648.4 <#35
Surface Area Analyses ID: 22-647

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-647 | Start Date | 02/17/04 |
| Customer | CNWRA | Start Time | 06:15:38 |
| Operator | MR | Elapsed Time | 56 min |
| Sample Wt | 1.5975 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 13.596 sq.m/g |
| Micropore Surface Area | 6.030 sq.m/g |
| Micropore Volume | 0.00260 ml/g |
| Correlation Coefficient | 0.99921 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-647 | Start Date | 02/17/04 |
| Customer | CNWRA | Start Time | 06:15:38 |
| Operator | MR | Elapsed Time | 56 min |
| Sample Wt | 1.5975 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 13.596 sq.m/g |
| Total Surface Area | 19.626 sq.m/g |
| Micropore Surface Area | 6.030 sq.m/g |
| Micropore Volume | 0.00260 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 8.7888 |
| Intercept | 1.67931 |
| Correlation Coefficient | 0.99921 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3517 | 4.746 |
| 0.3686 | 4.912 |
| 0.3832 | 5.050 |
| 0.3944 | 5.159 |
| 0.4089 | 5.286 |
| 0.4238 | 5.419 |
| 0.4356 | 5.519 |

- Mass (g) before outgassing 710/30
- Mass (g) after outgassing 710/31
19 May 05 MR

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by



From Page No.____ 19 May 05 MR cont.

| | |
|---|---|
| 0.4611 | 5.731 |
| 0.4878 | 5.943 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-647 | Start Date | 02/17/04 |
| Customer | CNWRA | Start Time | 06:15:38 |
| Operator | MR | Elapsed Time | 56 min |
| Sample Wt | 1.5975 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0184 |
| Intercept | 0.0051 |
| Correlation Coefficient | 0.99999 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 746.24 |
| 0.0001 | 0.276 | 0.042 | 746.25 |
| 0.0001 | 0.555 | 0.081 | 746.22 |
| 0.0002 | 0.877 | 0.122 | 746.26 |
| 0.0004 | 1.234 | 0.280 | 746.23 |
| 0.0006 | 1.580 | 0.440 | 746.30 |
| 0.0011 | 1.939 | 0.838 | 746.29 |
| 0.0020 | 2.316 | 1.504 | 746.25 |
| 0.0035 | 2.701 | 2.628 | 746.33 |
| 0.0059 | 3.096 | 4.386 | 746.28 |
| 0.0099 | 3.481 | 7.398 | 746.21 |
| 0.0164 | 3.786 | 12.212 | 746.25 |
| 0.0254 | 4.033 | 18.943 | 746.27 |
| 0.0313 | 4.153 | 23.390 | 746.19 |
| 0.0381 | 4.263 | 28.437 | 746.17 |
| 0.0457 | 4.374 | 34.114 | 746.15 |
| 0.0536 | 4.473 | 39.956 | 746.12 |
| 0.0585 | 4.535 | 43.668 | 746.10 |
| 0.0645 | 4.599 | 48.111 | 746.14 |
| 0.0708 | 4.663 | 52.854 | 746.13 |
| 0.0800 | 4.746 | 59.655 | 746.13 |
| 0.1010 | 4.912 | 75.364 | 746.11 |
| 0.1206 | 5.050 | 89.954 | 746.12 |
| 0.1363 | 5.159 | 101.718 | 746.07 |
| 0.1574 | 5.286 | 117.465 | 746.09 |
| 0.1799 | 5.419 | 134.229 | 746.04 |
| 0.1980 | 5.519 | 147.674 | 746.02 |
| 0.2377 | 5.731 | 177.300 | 745.96 |
| 0.2794 | 5.943 | 208.383 | 745.94 |
| 0.3184 | 6.144 | 237.477 | 745.89 |
| 0.3584 | 6.350 | 267.328 | 745.91 |
| 0.3989 | 6.564 | 297.512 | 745.86 |
| 0.4403 | 6.780 | 328.356 | 745.79 |

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by

From Page No.___ 19 May 05 MR cont.

Sample ID: NIST 1899 silicon nitride standard
Surface Area Analyses ID: 1899S

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 1899S | Start Date | 02/17/04 |
| Customer | CNWRA | Start Time | 07:50:42 |
| Operator | MR | Elapsed Time | 33 min |
| Sample Wt | 1.1444 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 10.193 sq.m/g |
| Micropore Surface Area | 0.242 sq.m/g |
| Micropore Volume | 0.00017 ml/g |
| Correlation Coefficient | 0.99991 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 1899S | Start Date | 02/17/04 |
| Customer | CNWRA | Start Time | 07:50:42 |
| Operator | MR | Elapsed Time | 33 min |
| Sample Wt | 1.1444 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 10.193 sq.m/g |
| Total Surface Area | 10.435 sq.m/g |
| Micropore Surface Area | 0.642 sq.m/g |
| Micropore Volume | 0.00017 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 6.5886 |
| Intercept | 0.10673 |
| Correlation Coefficient | 0.99991 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3518 | 2.418 |
| 0.3680 | 2.530 |
| 0.3818 | 2.624 |
| 0.3959 | 2.718 |
| 0.4098 | 2.811 |
| 0.4232 | 2.899 |
| 0.4364 | 2.984 |

- Mass(g) before outgassing: 710/30
- Mass(g) after outgassing 710/31

19 May 05 MR

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by



From Page No.___ 19 May 05 MR cont.

| | |
|---|---|
| 0.4619 | 3.148 |
| 0.4879 | 3.316 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 1899S | Start Date | 02/17/04 |
| Customer | CNWRA | Start Time | 07:50:42 |
| Operator | MR | Elapsed Time | 33 min |
| Sample Wt | 1.1444 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0191 |
| Intercept | 0.0056 |
| Correlation Coefficient | 0.99999 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 746.96 |
| 0.0001 | 0.385 | 0.049 | 746.99 |
| 0.0003 | 0.773 | 0.247 | 747.00 |
| 0.0017 | 1.193 | 1.266 | 746.97 |
| 0.0062 | 1.554 | 4.610 | 747.03 |
| 0.0185 | 1.871 | 13.801 | 747.01 |
| 0.0330 | 2.061 | 24.634 | 747.00 |
| 0.0397 | 2.127 | 29.674 | 747.03 |
| 0.0482 | 2.201 | 36.009 | 747.05 |
| 0.0587 | 2.280 | 43.830 | 747.03 |
| 0.0645 | 2.320 | 48.178 | 747.05 |
| 0.0718 | 2.368 | 53.618 | 747.04 |
| 0.0801 | 2.418 | 59.853 | 747.03 |
| 0.1003 | 2.530 | 74.910 | 747.00 |
| 0.1186 | 2.624 | 88.620 | 747.03 |
| 0.1384 | 2.718 | 103.418 | 747.00 |
| 0.1588 | 2.811 | 118.657 | 746.99 |
| 0.1790 | 2.899 | 133.719 | 746.99 |
| 0.1992 | 2.984 | 148.805 | 746.94 |
| 0.2389 | 3.148 | 178.431 | 746.93 |
| 0.2795 | 3.316 | 208.755 | 746.93 |
| 0.3188 | 3.479 | 238.086 | 746.88 |
| 0.3596 | 3.650 | 268.561 | 746.88 |
| 0.3994 | 3.823 | 298.324 | 746.86 |
| 0.4397 | 3.998 | 328.397 | 746.81 |

19 May 05 MR

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by

From Page No. 19 May 05 MR cont.

see initial entry: 710/18-19

sample prefixes: NCEWDP22PC0305 ①

Surface ~~Aa~~ 19 May 05 Area Analyses of NCEWDP22PC-0305 <#35 Sonic Core Samples.

Initial, before outgassing

| Sample ID ① | Surface Area Analyses Sample ID | Mass(g) of tube, cap + insert | Aliquot ~~of~~ 19 May 05 MR Mass(g) |
|---|---|---|---|
| 747.4-748.8 <#35 | 22-748 | 29.5351 | 1.8451 |
| 710.6-712.1 <#35 | 22-711 | 29.8117 | 1.8989 |

For every sample from 19 May 2005 and forward, the sample containers of NCEWDP22PC-0305-"interval"-<#35 will be gently rolled prior to aliquot removal to avoid a bias due to grain size settling within the container.

19 May 05 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by



From Page No. 20 May 05 MR

See initial entry: 710/18-19

Sample prefixes: NCEWDP22PC0305 ①

Surface Area Analyses of NCEWDP22PC0305 <#35 Sonic Core Samples. after outgassing

After outgassing

| Sample ID ① | Surface Area Analyses Sample ID | Total Mass(g) | Outgass Sample Mass(g) * |
|---|---|---|---|
| 747.4-748.8 <#35 | 22-748 | 31.1945 | 1.6594 |
| 710.6-712.1 <#35 | 22-711 | 31.6041 | 1.7924 |

*calculation

20 May 05 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by

From Page No. 20 May 05 MR cont.

Sample ID: NCEWDP22PC-0305 710.6-712.1 < #35
surface area analyses: 22-711
mass(g) before outgassing: 710/38
mass(g) after outgassing: 710/39

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-711 | Start Date | 02/19/04 |
| Customer | CNWRA | Start Time | 03:50:30 |
| Operator | MR | Elapsed Time | 37 min |
| Sample Wt | 1.7924 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 7.611 sq.m/g |
| Micropore Surface Area | 2.600 sq.m/g |
| Micropore Volume | 0.00111 ml/g |
| Correlation Coefficient | 0.99973 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-711 | Start Date | 02/19/04 |
| Customer | CNWRA | Start Time | 03:50:30 |
| Operator | MR | Elapsed Time | 37 min |
| Sample Wt | 1.7924 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 7.611 sq.m/g |
| Total Surface Area | 10.211 sq.m/g |
| Micropore Surface Area | 2.600 sq.m/g |
| Micropore Volume | 0.00111 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 4.9197 |
| Intercept | 0.71887 |
| Correlation Coefficient | 0.99973 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3529 | 2.447 |
| 0.3680 | 2.527 |
| 0.3808 | 2.594 |
| 0.3953 | 2.667 |
| 0.4095 | 2.738 |
| 0.4227 | 2.803 |
| 0.4362 | 2.869 |



Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



From Page No. 20 May 05 MR cont.

| | |
|---|---|
| 0.4618 | 2.989 |
| 0.4879 | 3.112 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-711 | Start Date | 02/19/04 |
| Customer | CNWRA | Start Time | 03:50:30 |
| Operator | MR | Elapsed Time | 37 min |
| Sample Wt | 1.7924 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0161 |
| Intercept | 0.0032 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 748.86 |
| 0.0000 | 0.246 | 0.032 | 748.91 |
| 0.0001 | 0.497 | 0.082 | 748.88 |
| 0.0004 | 0.785 | 0.290 | 748.96 |
| 0.0014 | 1.095 | 1.046 | 748.90 |
| 0.0033 | 1.378 | 2.442 | 748.91 |
| 0.0066 | 1.655 | 4.916 | 748.97 |
| 0.0146 | 1.926 | 10.926 | 749.02 |
| 0.0279 | 2.106 | 20.926 | 748.97 |
| 0.0354 | 2.172 | 26.489 | 749.06 |
| 0.0436 | 2.236 | 32.643 | 749.05 |
| 0.0539 | 2.300 | 40.362 | 749.07 |
| 0.0597 | 2.337 | 44.730 | 749.10 |
| 0.0693 | 2.389 | 51.899 | 749.10 |
| 0.0814 | 2.447 | 60.961 | 749.06 |
| 0.1002 | 2.527 | 75.088 | 749.09 |
| 0.1173 | 2.594 | 87.865 | 749.17 |
| 0.1376 | 2.667 | 103.070 | 749.11 |
| 0.1585 | 2.738 | 118.707 | 749.15 |
| 0.1782 | 2.803 | 133.485 | 749.10 |
| 0.1990 | 2.869 | 149.057 | 749.11 |
| 0.2388 | 2.989 | 178.859 | 749.05 |
| 0.2795 | 3.112 | 209.326 | 749.03 |
| 0.3181 | 3.231 | 238.285 | 749.01 |
| 0.3592 | 3.358 | 269.010 | 748.97 |
| 0.3995 | 3.488 | 299.199 | 748.94 |
| 0.4401 | 3.621 | 329.583 | 748.91 |

20 May 05 MR



Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

From Page No.___ 26 May 05 MR cont.

Sample ID: NC-EWDP-22PC-0305 747.4-748.8 <#35
Surface area analyses: 22-748
mass (g) before outgassing: 710/38
mass (g) after outgassing 710/39

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-748 | Start Date | 02/19/04 |
| Customer | CNWRA | Start Time | 02:39:32 |
| Operator | MR | Elapsed Time | 45 min |
| Sample Wt | 1.6594 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 11.891 sq.m/g |
| Micropore Surface Area | 4.950 sq.m/g |
| Micropore Volume | 0.00215 ml/g |
| Correlation Coefficient | 0.99960 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-748 | Start Date | 02/19/04 |
| Customer | CNWRA | Start Time | 02:39:32 |
| Operator | MR | Elapsed Time | 45 min |
| Sample Wt | 1.6594 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 11.891 sq.m/g |
| Total Surface Area | 16.841 sq.m/g |
| Micropore Surface Area | 4.950 sq.m/g |
| Micropore Volume | 0.00215 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 7.6864 |
| Intercept | 1.38795 |
| Correlation Coefficient | 0.99960 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3522 | 4.081 |
| 0.3686 | 4.215 |
| 0.3804 | 4.315 |
| 0.3939 | 4.423 |
| 0.4094 | 4.544 |
| 0.4227 | 4.647 |
| 0.4359 | 4.746 |

To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



From Page No.___ 20 May 05 MR cont.

| | |
|---|---|
| 0.4611 | 4.931 |
| 0.4872 | 5.118 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-748 | Start Date | 02/19/04 |
| Customer | CNWRA | Start Time | 02:39:32 |
| Operator | MR | Elapsed Time | 45 min |
| Sample Wt | 1.6594 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0168 |
| Intercept | 0.0025 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 747.99 |
| 0.0000 | 0.267 | 0.029 | 748.02 |
| 0.0001 | 0.537 | 0.071 | 748.02 |
| 0.0002 | 0.846 | 0.165 | 748.05 |
| 0.0004 | 1.161 | 0.262 | 748.08 |
| 0.0008 | 1.541 | 0.580 | 748.10 |
| 0.0015 | 1.888 | 1.116 | 748.13 |
| 0.0028 | 2.243 | 2.081 | 748.16 |
| 0.0049 | 2.604 | 3.676 | 748.19 |
| 0.0086 | 2.962 | 6.463 | 748.19 |
| 0.0155 | 3.258 | 11.588 | 748.22 |
| 0.0257 | 3.489 | 19.193 | 748.22 |
| 0.0321 | 3.595 | 24.036 | 748.28 |
| 0.0395 | 3.691 | 29.578 | 748.30 |
| 0.0478 | 3.790 | 35.795 | 748.25 |
| 0.0564 | 3.876 | 42.238 | 748.28 |
| 0.0617 | 3.927 | 46.182 | 748.29 |
| 0.0697 | 3.996 | 52.147 | 748.28 |
| 0.0806 | 4.081 | 60.282 | 748.29 |
| 0.1010 | 4.215 | 75.560 | 748.29 |
| 0.1168 | 4.315 | 87.383 | 748.30 |
| 0.1357 | 4.423 | 101.521 | 748.29 |
| 0.1582 | 4.544 | 118.405 | 748.28 |
| 0.1783 | 4.647 | 133.428 | 748.27 |
| 0.1985 | 4.746 | 148.558 | 748.26 |
| 0.2378 | 4.931 | 177.890 | 748.22 |
| 0.2784 | 5.118 | 208.275 | 748.24 |
| 0.3186 | 5.303 | 238.423 | 748.25 |
| 0.3587 | 5.490 | 268.358 | 748.23 |
| 0.3989 | 5.675 | 298.451 | 748.22 |
| 0.4408 | 5.874 | 329.830 | 748.23 |

To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

From Page No. 20 May 05 MR cont.
See initial entry: 710/18-19
sample prefixes: NCEWDP22PC 0305 ①

Surface Area Analyses of NCEWDP 22PC-0305
<#35 Sonic Core Samples Prior to Outgassing

Initial, before outgassing

| Sample ID ① | Surface Area Analyses Sample ID | Mass(g) of tube, cap + insert | Aliquot Mass(g) |
|---|---|---|---|
| 618.5-620.5 <#35 | 22-619 | 29.4939 | 1.7715 |
| 740.5-742.0 <#35 | 22-741 | 29.0830 | 1.9858 |
| 760.3-761.6 <#35 | 22-760 | 28.6473 | 1.86663 |

20 May 05 MR

To Page No.





From Page No. 23 May 05 MR
see initial entry: 710/18-19
sample prefixes: NCEWDP-22PC-0305 ①

Surface Area Analyses of NCEWDP22PC-0305
<#35 Sonic Core Samples After Outgassing

After outgassing

| Sample ID ① | Surface Area Analyses Sample ID | Total Mass(g) | Outgass Sample Mass(g)* |
|---|---|---|---|
| 618.5-620.5 <#35 | 22-619 | 31.1672 | 1.6733 |
| 740.5-742.0 <#35 | 22-741 | 30.9143 | 1.8313 |
| 760.3-761.6 <#35 | 22-760 | 30.4329 | 1.7856 |

* calculation

24 May 05 MR

To Page No.

From Page No.____ 24 May 05 MR
sample ID: NCEWDP22PC0305 618.5-620.5 <#35
surface area analyses ID: 22-619
mass (g) before outgassing: 710/44
mass (g) after outgassing: 710/45

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-619 | Start Date | 02/22/04 |
| Customer | CNWRA | Start Time | 03:49:29 |
| Operator | MR | Elapsed Time | 42 min |
| Sample Wt | 1.6733 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 14.625 sq.m/g |
| Micropore Surface Area | 5.743 sq.m/g |
| Micropore Volume | 0.00247 ml/g |
| Correlation Coefficient | 0.99964 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-619 | Start Date | 02/22/04 |
| Customer | CNWRA | Start Time | 03:49:29 |
| Operator | MR | Elapsed Time | 42 min |
| Sample Wt | 1.6733 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 14.625 sq.m/g |
| Total Surface Area | 20.368 sq.m/g |
| Micropore Surface Area | 5.743 sq.m/g |
| Micropore Volume | 0.00247 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 9.4537 |
| Intercept | 1.59809 |
| Correlation Coefficient | 0.99964 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3529 | 4.916 |
| 0.3678 | 5.071 |
| 0.3804 | 5.195 |
| 0.3949 | 5.339 |
| 0.4083 | 5.469 |
| 0.4228 | 5.605 |
| 0.4361 | 5.729 |

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



From Page No.____ 24 May 05 MR cont.

| | |
|---|---|
| 0.4606 | 5.952 |
| 0.4875 | 6.190 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-619 | Start Date | 02/22/04 |
| Customer | CNWRA | Start Time | 03:49:29 |
| Operator | MR | Elapsed Time | 42 min |
| Sample Wt | 1.6733 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0178 |
| Intercept | 0.0028 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 741.09 |
| 0.0000 | 0.264 | 0.027 | 741.09 |
| 0.0001 | 0.532 | 0.057 | 741.14 |
| 0.0001 | 0.843 | 0.092 | 741.26 |
| 0.0003 | 1.186 | 0.215 | 741.33 |
| 0.0005 | 1.517 | 0.344 | 741.42 |
| 0.0010 | 1.941 | 0.714 | 741.51 |
| 0.0017 | 2.303 | 1.232 | 741.54 |
| 0.0028 | 2.677 | 2.108 | 741.62 |
| 0.0046 | 3.068 | 3.431 | 741.70 |
| 0.0074 | 3.462 | 5.513 | 741.82 |
| 0.0119 | 3.791 | 8.859 | 741.89 |
| 0.0195 | 4.066 | 14.457 | 741.92 |
| 0.0295 | 4.286 | 21.854 | 742.04 |
| 0.0357 | 4.391 | 26.495 | 742.06 |
| 0.0426 | 4.491 | 31.597 | 742.09 |
| 0.0505 | 4.594 | 37.504 | 742.15 |
| 0.0558 | 4.655 | 41.401 | 742.19 |
| 0.0613 | 4.720 | 45.491 | 742.18 |
| 0.0698 | 4.808 | 51.816 | 742.18 |
| 0.0814 | 4.916 | 60.402 | 742.21 |
| 0.0999 | 5.071 | 74.169 | 742.22 |
| 0.1167 | 5.195 | 86.612 | 742.23 |
| 0.1370 | 5.339 | 101.717 | 742.23 |
| 0.1566 | 5.469 | 116.203 | 742.27 |
| 0.1784 | 5.605 | 132.388 | 742.26 |
| 0.1988 | 5.729 | 147.526 | 742.26 |
| 0.2369 | 5.952 | 175.833 | 742.28 |
| 0.2789 | 6.190 | 207.011 | 742.26 |
| 0.3186 | 6.418 | 236.507 | 742.26 |
| 0.3580 | 6.644 | 265.719 | 742.23 |
| 0.3994 | 6.883 | 296.443 | 742.22 |
| 0.4409 | 7.121 | 327.212 | 742.17 |

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

From Page No. 24 May 05 MR cont.

Sample ID: NCEWDP22PC0305 740.5-742.0 <#35
Surface area analyses ID: 22-741
mass(g) before outgassing: 710/44
mass(g) after outgassing: 710/45

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-741 | Start Date | 02/22/04 |
| Customer | CNWRA | Start Time | 05:15:50 |
| Operator | MR | Elapsed Time | 46 min |
| Sample Wt | 1.8313 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 16.150 sq.m/g |
| Micropore Surface Area | 6.261 sq.m/g |
| Micropore Volume | 0.00270 ml/g |
| Correlation Coefficient | 0.99971 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-741 | Start Date | 02/22/04 |
| Customer | CNWRA | Start Time | 05:15:50 |
| Operator | MR | Elapsed Time | 46 min |
| Sample Wt | 1.8313 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 16.150 sq.m/g |
| Total Surface Area | 22.410 sq.m/g |
| Micropore Surface Area | 6.261 sq.m/g |
| Micropore Volume | 0.00270 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 10.4394 |
| Intercept | 1.74422 |
| Correlation Coefficient | 0.99971 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3518 | 5.399 |
| 0.3691 | 5.594 |
| 0.3805 | 5.720 |
| 0.3941 | 5.864 |
| 0.4087 | 6.021 |
| 0.4217 | 6.157 |
| 0.4362 | 6.308 |



Witnessed & Understood by me, Date Invented by Date Recorded by



From Page No. 24 May 05 MR cont.

| | |
|---|---|
| 0.4611 | 6.556 |
| 0.4875 | 6.816 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.1 |
| Sample ID | 22-741 | Start Date | 02/22/0 |
| Customer | CNWRA | Start Time | 05:15:5 |
| Operator | MR | Elapsed Time | 46 mi |
| Sample Wt | 1.8313 g | Outgas Time | 720 mi |
| Profile | BET5-T | Outgas Temperature | 350 |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0178 |
| Intercept | 0.0025 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 745.98 |
| 0.0000 | 0.244 | 0.029 | 746.05 |
| 0.0001 | 0.487 | 0.059 | 746.03 |
| 0.0001 | 0.770 | 0.088 | 746.02 |
| 0.0002 | 1.082 | 0.172 | 746.07 |
| 0.0003 | 1.433 | 0.236 | 746.05 |
| 0.0006 | 1.823 | 0.438 | 746.05 |
| 0.0009 | 2.163 | 0.669 | 746.02 |
| 0.0015 | 2.518 | 1.137 | 746.07 |
| 0.0025 | 2.888 | 1.850 | 746.11 |
| 0.0039 | 3.271 | 2.946 | 746.08 |
| 0.0061 | 3.668 | 4.586 | 746.09 |
| 0.0092 | 3.993 | 6.839 | 746.12 |
| 0.0142 | 4.285 | 10.621 | 746.13 |
| 0.0218 | 4.533 | 16.249 | 746.15 |
| 0.0270 | 4.662 | 20.156 | 746.13 |
| 0.0329 | 4.781 | 24.566 | 746.15 |
| 0.0398 | 4.895 | 29.663 | 746.13 |
| 0.0467 | 5.002 | 34.874 | 746.09 |
| 0.0540 | 5.100 | 40.283 | 746.12 |
| 0.0589 | 5.163 | 43.939 | 746.12 |
| 0.0643 | 5.228 | 47.955 | 746.12 |
| 0.0701 | 5.294 | 52.297 | 746.11 |
| 0.0802 | 5.399 | 59.803 | 746.09 |
| 0.1017 | 5.594 | 75.841 | 746.07 |
| 0.1169 | 5.720 | 87.209 | 746.06 |
| 0.1359 | 5.864 | 101.357 | 746.05 |
| 0.1572 | 6.021 | 117.309 | 746.07 |
| 0.1768 | 6.157 | 131.868 | 746.04 |
| 0.1990 | 6.308 | 148.431 | 746.04 |
| 0.2377 | 6.556 | 177.300 | 746.02 |
| 0.2788 | 6.816 | 208.012 | 746.03 |
| 0.3174 | 7.062 | 236.785 | 745.98 |
| 0.3585 | 7.323 | 267.447 | 745.95 |
| 0.3999 | 7.581 | 298.297 | 745.98 |
| 0.4407 | 7.844 | 328.773 | 745.99 |



Witnessed & Understood by me, Date Invented by Date Recorded by

From Page No.____ 24 May 05 MR cont.

sample ID: NCEWDP22PC0305 760.3-761.6 <#35

Surface area analyser: 22-760

mass before outgassing: 710/44

mass after outgassing: 710/45

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-760 | Start Date | 02/22/04 |
| Customer | CNWRA | Start Time | 06:22:18 |
| Operator | MR | Elapsed Time | 42 min |
| Sample Wt | 1.7856 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 9.133 sq.m/g |
| Micropore Surface Area | 2.953 sq.m/g |
| Micropore Volume | 0.00126 ml/g |
| Correlation Coefficient | 0.99981 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-760 | Start Date | 02/22/04 |
| Customer | CNWRA | Start Time | 06:22:18 |
| Operator | MR | Elapsed Time | 42 min |
| Sample Wt | 1.7856 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 9.133 sq.m/g |
| Total Surface Area | 12.086 sq.m/g |
| Micropore Surface Area | 2.953 sq.m/g |
| Micropore Volume | 0.00126 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 5.9039 |
| Intercept | 0.81596 |
| Correlation Coefficient | 0.99981 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3520 | 2.885 |
| 0.3686 | 2.991 |
| 0.3806 | 3.064 |
| 0.3950 | 3.153 |
| 0.4089 | 3.235 |
| 0.4233 | 3.319 |
| 0.4360 | 3.394 |

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by



From Page No.____ 24 May 05 MR cont.

| | |
|---|---|
| 0.4613 | 3.537 |
| 0.4878 | 3.689 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-760 | Start Date | 02/22/04 |
| Customer | CNWRA | Start Time | 06:22:18 |
| Operator | MR | Elapsed Time | 42 min |
| Sample Wt | 1.7856 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0172 |
| Intercept | 0.0029 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 747.12 |
| 0.0001 | 0.247 | 0.038 | 747.13 |
| 0.0001 | 0.496 | 0.078 | 747.13 |
| 0.0003 | 0.785 | 0.187 | 747.15 |
| 0.0008 | 1.099 | 0.605 | 747.18 |
| 0.0019 | 1.395 | 1.383 | 747.14 |
| 0.0038 | 1.694 | 2.871 | 747.14 |
| 0.0072 | 1.989 | 5.411 | 747.13 |
| 0.0145 | 2.259 | 10.805 | 747.14 |
| 0.0260 | 2.453 | 19.421 | 747.13 |
| 0.0330 | 2.535 | 24.654 | 747.15 |
| 0.0407 | 2.609 | 30.409 | 747.14 |
| 0.0499 | 2.683 | 37.312 | 747.15 |
| 0.0589 | 2.749 | 44.001 | 747.14 |
| 0.0644 | 2.788 | 48.125 | 747.15 |
| 0.0710 | 2.832 | 53.073 | 747.18 |
| 0.0803 | 2.885 | 59.983 | 747.13 |
| 0.1010 | 2.991 | 75.495 | 747.13 |
| 0.1171 | 3.064 | 87.458 | 747.16 |
| 0.1372 | 3.153 | 102.520 | 747.09 |
| 0.1575 | 3.235 | 117.700 | 747.09 |
| 0.1791 | 3.319 | 133.838 | 747.08 |
| 0.1986 | 3.394 | 148.344 | 747.03 |
| 0.2379 | 3.537 | 177.746 | 747.03 |
| 0.2793 | 3.689 | 208.615 | 747.03 |
| 0.3183 | 3.831 | 237.735 | 746.97 |
| 0.3592 | 3.987 | 268.338 | 746.96 |
| 0.3987 | 4.140 | 297.833 | 746.94 |
| 0.4409 | 4.303 | 329.291 | 746.87 |

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by

From Page No. 24 May 05 cont. MR

see initial entry: 710/18-19

sample ID prefixes: NCEWDP22PC0305 (1)

Surface Area Analyses of NCEWDP22PC0305 <#35 Sonic Core Samples Prior to Outgassing

Initial, before outgassing

| Sample ID (1) | Surface Area Analyses Sample ID | Mass(g) of tube, cap + insert | Aliquot Mass(g) |
|---|---|---|---|
| 476.9-478.5 <#35 | 22-~~476~~ 477 (25 May 05 MR) | 29.7787 | 1.7018 |
| 522.1-523.5 <#35 | 22-522 | 29.5287 | 1.8681 |
| 686.1-687.4 <#35 | 22-686 | 29.5451 | 1.8304 |

24 May 05 MR

To Page No.

Witnessed & Understood by me, Date Invented by Date Recorded by



From Page No. 25 May 05 MR

see initial entry: 710/18-19

Sample ID prefixes: NCEWDP22PC0305 (1)

Surface Area Analyses of NCEWDP22PC0305 <#35 Sonic Core Samples After Outgassing

After outgassing

| Sample ID (1) | Surface Area Analyses Sample ID | Total Mass(g) | Outgassed Sample Mass* |
|---|---|---|---|
| 476.9-478.5 <#35 | 22-~~476~~ 477 (25 May 05 MR) | 31.3723 | 1.5936 |
| 522.1-523.5 <#35 | 22-522 | 31.2069 | 1.6782 |
| 686.1-687.4 <#35 | 22-686 | 31.2799 | 1.7348 |

*calculation

25 May 05 MR

To Page No.

Witnessed & Understood by me, Date Invented by Date Recorded by

From Page No.____ 26 May 05 MR 26 May 05 MR

Sample ID: NCF WDP 22PC 0305 ~~4769-4~~ 4769-4785 ~~4~~35
Surface area analysis ID: 22-477
Mass (g) before outgassing: 710/52
Mass (g) after outgassing: 710/53

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | ~~22-476~~ 22-477 | Start Date | 02/24/04 |
| Customer | CNWRA 26 May 05 | Start Time | 02:56:16 |
| Operator | MR MR | Elapsed Time | 48 min |
| Sample Wt | 1.5936 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 15.929 sq.m/g |
| Micropore Surface Area | 6.788 sq.m/g |
| Micropore Volume | 0.00293 ml/g |
| Correlation Coefficient | 0.99933 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | ~~22-476~~ 22-477 | Start Date | 02/24/04 |
| Customer | CNWRA 26 May 05 | Start Time | 02:56:16 |
| Operator | MR MR | Elapsed Time | 48 min |
| Sample Wt | 1.5936 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 15.929 sq.m/g |
| Total Surface Area | 22.717 sq.m/g |
| Micropore Surface Area | 6.788 sq.m/g |
| Micropore Volume | 0.00293 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 10.2966 |
| Intercept | 1.89487 |
| Correlation Coefficient | 0.99933 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3527 | 5.502 |
| 0.3682 | 5.679 |
| 0.3796 | 5.804 |
| 0.3942 | 5.966 |
| 0.4081 | 6.113 |
| 0.4230 | 6.267 |
| 0.4357 | 6.396 |
| 0.4607 | 6.636 |
| 0.4879 | 6.893 |

Page No.____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by



From Page No.____ 26 May 05 MR cont.

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | ~~22-476~~ 22-477 | Start Date | 02/24/04 |
| Customer | CNWRA 26 May 05 | Start Time | 02:56:16 |
| Operator | MR MR | Elapsed Time | 48 min |
| Sample Wt | 1.5936 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0165 |
| Intercept | 0.0030 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 744.66 |
| 0.0000 | 0.281 | 0.033 | 744.64 |
| 0.0001 | 0.560 | 0.073 | 744.69 |
| 0.0002 | 0.882 | 0.162 | 744.70 |
| 0.0003 | 1.216 | 0.187 | 744.68 |
| 0.0005 | 1.618 | 0.342 | 744.80 |
| 0.0007 | 1.987 | 0.531 | 744.77 |
| 0.0013 | 2.370 | 0.940 | 744.77 |
| 0.0022 | 2.770 | 1.605 | 744.83 |
| 0.0036 | 3.187 | 2.706 | 744.81 |
| 0.0058 | 3.614 | 4.325 | 744.85 |
| 0.0089 | 3.989 | 6.625 | 744.87 |
| 0.0142 | 4.326 | 10.611 | 744.83 |
| 0.0222 | 4.608 | 16.562 | 744.89 |
| 0.0278 | 4.751 | 20.742 | 744.87 |
| 0.0344 | 4.883 | 25.598 | 744.91 |
| 0.0417 | 5.009 | 31.041 | 744.92 |
| 0.0495 | 5.123 | 36.892 | 744.91 |
| 0.0573 | 5.229 | 42.679 | 744.94 |
| 0.0622 | 5.294 | 46.329 | 744.98 |
| 0.0700 | 5.386 | 52.181 | 745.01 |
| 0.0812 | 5.502 | 60.510 | 745.03 |
| 0.1004 | 5.679 | 74.838 | 745.06 |
| 0.1156 | 5.804 | 86.117 | 745.05 |
| 0.1361 | 5.966 | 101.396 | 745.05 |
| 0.1564 | 6.113 | 116.518 | 745.09 |
| 0.1787 | 6.267 | 133.165 | 745.07 |
| 0.1981 | 6.396 | 147.620 | 745.04 |
| 0.2371 | 6.636 | 176.631 | 745.08 |
| 0.2794 | 6.893 | 208.168 | 745.03 |
| 0.3172 | 7.114 | 236.346 | 745.03 |
| 0.3586 | 7.366 | 267.184 | 745.02 |
| 0.3977 | 7.603 | 296.264 | 744.97 |
| 0.4422 | 7.867 | 329.438 | 744.99 |

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by

From Page No.___ 26 May MR cont.

Sample ID: NCEWDP22PC0305 522.1-523.5 <#35
surface area analyses ID: 22-522
Mass (g) before outgassing: 710152
mass 26may05 MR mass(g) after outgassing: 710153

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-522 | Start Date | 02/24/04 |
| Customer | CNWRA | Start Time | 05:29:04 |
| Operator | MR | Elapsed Time | 52 min |
| Sample Wt | 1.6782 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 21.061 sq.m/g |
| Micropore Surface Area | 8.553 sq.m/g |
| Micropore Volume | 0.00366 ml/g |
| Correlation Coefficient | 0.99924 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-522 | Start Date | 02/24/04 |
| Customer | CNWRA | Start Time | 05:29:04 |
| Operator | MR | Elapsed Time | 52 min |
| Sample Wt | 1.6782 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 21.061 sq.m/g |
| Total Surface Area | 29.614 sq.m/g |
| Micropore Surface Area | 8.553 sq.m/g |
| Micropore Volume | 0.00366 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 13.6139 |
| Intercept | 2.36639 |
| Correlation Coefficient | 0.99924 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3517 | 7.117 |
| 0.3692 | 7.384 |
| 0.3798 | 7.543 |
| 0.3942 | 7.747 |
| 0.4088 | 7.952 |
| 0.4215 | 8.129 |
| 0.4359 | 8.319 |
| 0.4617 | 8.649 |
| 0.4866 | 8.956 |

Page No.____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



From Page No.___ 26 May 05 MR cont.

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-522 | Start Date | 02/24/04 |
| Customer | CNWRA | Start Time | 05:29:04 |
| Operator | MR | Elapsed Time | 52 min |
| Sample Wt | 1.6782 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0169 |
| Intercept | 0.0024 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 745.20 |
| 0.0000 | 0.266 | 0.029 | 745.25 |
| 0.0001 | 0.531 | 0.053 | 745.24 |
| 0.0001 | 0.841 | 0.079 | 745.28 |
| 0.0002 | 1.182 | 0.172 | 745.30 |
| 0.0003 | 1.515 | 0.190 | 745.33 |
| 0.0004 | 1.939 | 0.307 | 745.37 |
| 0.0005 | 2.312 | 0.407 | 745.34 |
| 0.0010 | 2.838 | 0.745 | 745.42 |
| 0.0015 | 3.248 | 1.125 | 745.43 |
| 0.0024 | 3.678 | 1.794 | 745.44 |
| 0.0037 | 4.126 | 2.736 | 745.48 |
| 0.0055 | 4.593 | 4.070 | 745.50 |
| 0.0082 | 5.073 | 6.108 | 745.53 |
| 0.0114 | 5.422 | 8.534 | 745.58 |
| 0.0166 | 5.742 | 12.400 | 745.60 |
| 0.0236 | 6.023 | 17.580 | 745.57 |
| 0.0284 | 6.174 | 21.195 | 745.60 |
| 0.0340 | 6.319 | 25.369 | 745.62 |
| 0.0404 | 6.461 | 30.111 | 745.60 |
| 0.0469 | 6.591 | 34.959 | 745.60 |
| 0.0537 | 6.715 | 40.027 | 745.61 |
| 0.0583 | 6.795 | 43.448 | 745.60 |
| 0.0635 | 6.878 | 47.311 | 745.63 |
| 0.0703 | 6.983 | 52.409 | 745.62 |
| 0.0800 | 7.117 | 59.676 | 745.61 |
| 0.1018 | 7.384 | 75.882 | 745.59 |
| 0.1159 | 7.543 | 86.418 | 745.57 |
| 0.1360 | 7.747 | 101.423 | 745.55 |
| 0.1573 | 7.952 | 117.260 | 745.52 |
| 0.1764 | 8.129 | 131.482 | 745.46 |
| 0.1985 | 8.319 | 147.964 | 745.42 |
| 0.2386 | 8.649 | 177.873 | 745.38 |
| 0.2774 | 8.956 | 206.750 | 745.34 |
| 0.3175 | 9.264 | 236.651 | 745.29 |
| 0.3586 | 9.585 | 267.218 | 745.23 |
| 0.3981 | 9.886 | 296.642 | 745.20 |
| 0.4415 | 10.225 | 328.988 | 745.16 |

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

Project No.
Book No.
TITLE

From Page No.

26 May 05 MR cont.
Sample ID: NCEWDP22PC 0305 6686.1-6687.4 <#35
Surface area analyses ID: 22-6686
Mass(g) before outgassing: 710152
Mass(g) after outgassing: 710153

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-686 | Start Date | 02/24/04 |
| Customer | CNWRA | Start Time | 06:42:15 |
| Operator | MR | Elapsed Time | 53 min |
| Sample Wt | 1.7348 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 15.086 sq.m/g |
| Micropore Surface Area | 6.171 sq.m/g |
| Micropore Volume | 0.00265 ml/g |
| Correlation Coefficient | 0.99946 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-686 | Start Date | 02/24/04 |
| Customer | CNWRA | Start Time | 06:42:15 |
| Operator | MR | Elapsed Time | 53 min |
| Sample Wt | 1.7348 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 15.086 sq.m/g |
| Total Surface Area | 21.257 sq.m/g |
| Micropore Surface Area | 6.171 sq.m/g |
| Micropore Volume | 0.00265 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 9.7515 |
| Intercept | 1.71591 |
| Correlation Coefficient | 0.99946 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3519 | 5.123 |
| 0.3701 | 5.321 |
| 0.3799 | 5.425 |
| 0.3943 | 5.571 |
| 0.4092 | 5.719 |
| 0.4221 | 5.844 |
| 0.4357 | 5.976 |
| 0.4609 | 6.210 |
| 0.4878 | 6.452 |

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by



TITLE
Project No.
Book No.

From Page No.

26 May 05 MR cont.

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-686 | Start Date | 02/24/04 |
| Customer | CNWRA | Start Time | 06:42:15 |
| Operator | MR | Elapsed Time | 53 min |
| Sample Wt | 1.7348 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 350 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0179 |
| Intercept | 0.0056 |
| Correlation Coefficient | 0.99999 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 745.26 |
| 0.0001 | 0.254 | 0.047 | 745.28 |
| 0.0001 | 0.510 | 0.091 | 745.30 |
| 0.0002 | 0.807 | 0.155 | 745.30 |
| 0.0004 | 1.136 | 0.332 | 745.31 |
| 0.0006 | 1.457 | 0.426 | 745.34 |
| 0.0008 | 1.791 | 0.633 | 745.34 |
| 0.0012 | 2.145 | 0.885 | 745.33 |
| 0.0020 | 2.513 | 1.468 | 745.33 |
| 0.0033 | 2.897 | 2.433 | 745.33 |
| 0.0052 | 3.295 | 3.877 | 745.32 |
| 0.0085 | 3.691 | 6.323 | 745.34 |
| 0.0134 | 4.004 | 10.006 | 745.33 |
| 0.0210 | 4.266 | 15.673 | 745.31 |
| 0.0266 | 4.400 | 19.828 | 745.30 |
| 0.0329 | 4.523 | 24.497 | 745.29 |
| 0.0400 | 4.641 | 29.796 | 745.27 |
| 0.0473 | 4.747 | 35.256 | 745.24 |
| 0.0549 | 4.846 | 40.899 | 745.22 |
| 0.0600 | 4.908 | 44.686 | 745.19 |
| 0.0656 | 4.973 | 48.900 | 745.16 |
| 0.0706 | 5.030 | 52.639 | 745.14 |
| 0.0802 | 5.123 | 59.725 | 745.11 |
| 0.1030 | 5.321 | 76.753 | 745.07 |
| 0.1160 | 5.425 | 86.431 | 745.05 |
| 0.1362 | 5.571 | 101.472 | 745.02 |
| 0.1579 | 5.719 | 117.646 | 744.99 |
| 0.1773 | 5.844 | 132.091 | 744.96 |
| 0.1981 | 5.976 | 147.602 | 744.92 |
| 0.2374 | 6.210 | 176.847 | 744.88 |
| 0.2793 | 6.452 | 208.053 | 744.85 |
| 0.3179 | 6.674 | 236.742 | 744.80 |
| 0.3585 | 6.906 | 267.021 | 744.75 |
| 0.3993 | 7.139 | 297.332 | 744.72 |
| 0.4409 | 7.374 | 328.314 | 744.68 |

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by

From Page No. 26 May 2005 MR cont.

Based on the initial instrument check (710/36-37) a more comprehensive approach to determining instrument performance and optimizing the instrument method was used. As a result some changes from the initial entry (710/18-19) will happen.

- increased frequency of challenges
- add ~~at~~ 26 May 05 MR additional standards with different values

For the set of 3 standards the following method parameters were changed.

outgass temp = from 350°C to 200°C
outgass time = from 720 mins to 180 mins.

Reagents:

NIST silicon nitride surface area standard 1899 (10 m²/g)

NIST alpha alumina surface area standard 8005 (2.09 m²/g)

Montmorillonite 061/94 SAZ*Na*<2*FD*SCr
- used in sorption experiments

26 May 2005 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



From Page No. 26 May 05 MR cont.

see initial entry 710/18-19 and 710/60

Surface Area Analyses of Standards and Known Materials.

Initial, before outgassing

| Sample ID | Surface Area Analyses Sample ID | Mass(g) of tube, cap & insert | Aliquot Mass (g) |
|---|---|---|---|
| NIST-1899 Silicon nitride | 1899S | 29.0362 | 1.1120 |
| NIST-8005 Alpha Alumina | 8005S | 28.6474 | 1.6742 |
| Montmorillonite | Mont | 29.4215 | 1.0106 |

27 May 05 MR cont.

27 May 05 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

Project No.
Book No.
TITLE

From Page No. 27 May 05 MR

see initial entry: 710/18-19 and 710/60

Surface Area Analyses of Standards and Known Materials:

After outgassing

| Sample ID | Surface Area Analyses Sample ID | Total Mass(g) | Outgassed * Sample Mass(g) |
|---|---|---|---|
| NIST-1899 Silicon nitride | 1899S | 30.1438 | 1.1076 |
| NIST-8005 Alpha Alumina | 8005S | 30.3227 | 1.6742 |
| Montmorillonite 710/60 | MONT | 30.2572 | 0.8357 |

*Calculation

27 May 05 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



TITLE
Project No.
Book No.

From Page No. 31 May 05 MR

Sample ID: NIST-1899 Silicon nitride
Surface area analyses ID: 1899S
Mass(g) before outgassing: 710/61
Mass(g) after outgassing: 710/62

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 1899S | Start Date | 02/26/04 |
| Customer | CNWRA | Start Time | 03:06:20 |
| Operator | MR | Elapsed Time | 30 min |
| Sample Wt | 1.1076 g | Outgas Time | 180 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 9.901 sq.m/g |
| Micropore Surface Area | 0.738 sq.m/g |
| Micropore Volume | 0.00023 ml/g |
| Correlation Coefficient | 0.99997 |

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 1899S | Start Date | 02/26/04 |
| Customer | CNWRA | Start Time | 03:06:20 |
| Operator | MR | Elapsed Time | 30 min |
| Sample Wt | 1.1076 g | Outgas Time | 180 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 9.901 sq.m/g |
| Total Surface Area | 10.639 sq.m/g |
| Micropore Surface Area | 0.738 sq.m/g |
| Micropore Volume | 0.00023 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 6.4004 |
| Intercept | 0.14825 |
| Correlation Coefficient | 0.99997 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3516 | 2.394 |
| 0.3679 | 2.503 |
| 0.3829 | 2.600 |
| 0.3961 | 2.686 |
| 0.4099 | 2.773 |
| 0.4233 | 2.858 |
| 0.4364 | 2.942 |
| 0.4619 | 3.104 |
| 0.4880 | 3.270 |

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

From Page No. 31 May 05 MR cont.

| | | | |
|---|---|---|---|
| Sample ID | 1899S | Start Date | 02/26/04 |
| Customer | CNWRA | Start Time | 03:06:20 |
| Operator | MR | Elapsed Time | 30 min |
| Sample Wt | 1.1076 g | Outgas Time | 180 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0191 |
| Intercept | 0.0029 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 748.84 |
| 0.0000 | 0.401 | 0.037 | 748.89 |
| 0.0004 | 0.797 | 0.292 | 748.88 |
| 0.0021 | 1.227 | 1.557 | 748.88 |
| 0.0070 | 1.581 | 5.223 | 748.85 |
| 0.0199 | 1.890 | 14.906 | 748.91 |
| 0.0347 | 2.070 | 25.991 | 748.90 |
| 0.0414 | 2.133 | 31.026 | 748.91 |
| 0.0501 | 2.203 | 37.490 | 748.87 |
| 0.0608 | 2.278 | 45.547 | 748.95 |
| 0.0701 | 2.338 | 52.542 | 749.06 |
| 0.0798 | 2.394 | 59.795 | 748.90 |
| 0.1001 | 2.503 | 74.976 | 748.92 |
| 0.1201 | 2.600 | 89.949 | 748.93 |
| 0.1388 | 2.686 | 103.929 | 748.90 |
| 0.1589 | 2.773 | 119.012 | 748.88 |
| 0.1791 | 2.858 | 134.140 | 748.86 |
| 0.1992 | 2.942 | 149.165 | 748.85 |
| 0.2390 | 3.104 | 178.946 | 748.80 |
| 0.2796 | 3.270 | 209.389 | 748.82 |
| 0.3189 | 3.434 | 238.778 | 748.81 |
| 0.3598 | 3.606 | 269.433 | 748.76 |
| 0.3992 | 3.780 | 298.953 | 748.83 |
| 0.4397 | 3.961 | 329.211 | 748.77 |

31 May 05 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



From Page No. 31 May 05 MR cont.
Sample ID: NIST 8005 Alpha alumina
Surface area analyser ID: 8005S
mass(g) before outgassing: 710/61
mass(g) after outgassing: 710/62

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |

| | | | |
|---|---|---|---|
| Sample ID | 8005S | Start Date | 02/26/04 |
| Customer | CNWRA | Start Time | 05:06:11 |
| Operator | MR | Elapsed Time | 27 min |
| Sample Wt | 1.6742 g | Outgas Time | 180 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 1.742 sq.m/g |
| Micropore Surface Area | 0.160 sq.m/g |
| Micropore Volume | 0.00006 ml/g |
| Correlation Coefficient | 0.99998 |

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |

| | | | |
|---|---|---|---|
| Sample ID | 8005S | Start Date | 02/26/04 |
| Customer | CNWRA | Start Time | 05:06:11 |
| Operator | MR | Elapsed Time | 27 min |
| Sample Wt | 1.6742 g | Outgas Time | 180 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 1.742 sq.m/g |
| Total Surface Area | 1.902 sq.m/g |
| Micropore Surface Area | 0.160 sq.m/g |
| Micropore Volume | 0.00006 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 1.1259 |
| Intercept | 0.03731 |
| Correlation Coefficient | 0.99998 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3528 | 0.435 |
| 0.3678 | 0.452 |
| 0.3823 | 0.468 |
| 0.3966 | 0.484 |
| 0.4103 | 0.499 |
| 0.4236 | 0.514 |
| 0.4366 | 0.528 |
| 0.4624 | 0.558 |
| 0.4880 | 0.587 |

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

From Page No.____ 31 May 05 cont.

| | | | |
|---|---|---|---|
| Sample ID | 8005S | Start Date | 02/26/04 |
| Customer | CNWRA | Start Time | 05:06:11 |
| Operator | MR | Elapsed Time | 27 min |
| Sample Wt | 1.6742 g | Outgas Time | 180 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0182 |
| Intercept | 0.0044 |
| Correlation Coefficient | 0.99999 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 750.58 |
| 0.0019 | 0.238 | 1.445 | 750.58 |
| 0.0140 | 0.332 | 10.489 | 750.60 |
| 0.0361 | 0.381 | 27.087 | 750.54 |
| 0.0426 | 0.391 | 31.959 | 750.61 |
| 0.0511 | 0.402 | 38.382 | 750.55 |
| 0.0600 | 0.413 | 45.038 | 750.57 |
| 0.0706 | 0.424 | 52.987 | 750.57 |
| 0.0813 | 0.435 | 61.043 | 750.56 |
| 0.1000 | 0.452 | 75.037 | 750.62 |
| 0.1193 | 0.468 | 89.535 | 750.56 |
| 0.1395 | 0.484 | 104.708 | 750.58 |
| 0.1596 | 0.499 | 119.789 | 750.60 |
| 0.1796 | 0.514 | 134.806 | 750.55 |
| 0.1996 | 0.528 | 149.805 | 750.59 |
| 0.2397 | 0.558 | 179.903 | 750.54 |
| 0.2796 | 0.587 | 209.889 | 750.55 |
| 0.3195 | 0.618 | 239.767 | 750.55 |
| 0.3597 | 0.650 | 269.943 | 750.52 |
| 0.3996 | 0.683 | 299.905 | 750.52 |
| 0.4396 | 0.717 | 329.927 | 750.52 |

31 May 05 MR

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by



From Page No.____ 31 May 05 MR cont.
Sample ID: montmorillonite 710/60
Surface area analyses ID Mont
mass (g) before outgassing: 710/61
mass (g) after outgassing: 710/62

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |

| | | | |
|---|---|---|---|
| Sample ID | MONT | Start Date | 02/26/04 |
| Customer | CNWRA | Start Time | 06:21:17 |
| Operator | MR | Elapsed Time | 1 hrs 5 min |
| Sample Wt | 0.8357 g | Outgas Time | 180 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 59.562 sq.m/g |
| Micropore Surface Area | 46.846 sq.m/g |
| Micropore Volume | 0.02076 ml/g |
| Correlation Coefficient | 0.99883 |

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |

| | | | |
|---|---|---|---|
| Sample ID | MONT | Start Date | 02/26/04 |
| Customer | CNWRA | Start Time | 06:21:17 |
| Operator | MR | Elapsed Time | 1 hrs 5 min |
| Sample Wt | 0.8357 g | Outgas Time | 180 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 59.562 sq.m/g |
| Total Surface Area | 106.408 sq.m/g |
| Micropore Surface Area | 46.846 sq.m/g |
| Micropore Volume | 0.02076 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 38.5016 |
| Intercept | 13.41705 |
| Correlation Coefficient | 0.99883 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3519 | 26.840 |
| 0.3684 | 27.566 |
| 0.3805 | 28.074 |
| 0.3927 | 28.594 |
| 0.4073 | 29.175 |
| 0.4229 | 29.784 |
| 0.4347 | 30.227 |
| 0.4601 | 31.122 |
| 0.4871 | 32.047 |

Page No.____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by

From Page No. 31 May 05 MR cont.

| | | | |
|---|---|---|---|
| Sample ID | MONT | Start Date | 02/26/04 |
| Customer | CNWRA | Start Time | 06:21:17 |
| Operator | MR | Elapsed Time | 1 hrs 5 min |
| Sample Wt | 0.8357 g | Outgas Time | 180 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0194 |
| Intercept | 0.0045 |
| Correlation Coefficient | 0.99999 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 750.66 |
| 0.0000 | 0.534 | 0.025 | 750.69 |
| 0.0001 | 1.069 | 0.047 | 750.73 |
| 0.0001 | 1.688 | 0.073 | 750.74 |
| 0.0002 | 2.372 | 0.141 | 750.74 |
| 0.0002 | 3.039 | 0.143 | 750.77 |
| 0.0002 | 3.738 | 0.178 | 750.74 |
| 0.0002 | 4.493 | 0.178 | 750.74 |
| 0.0003 | 5.281 | 0.206 | 750.73 |
| 0.0003 | 6.128 | 0.207 | 750.75 |
| 0.0003 | 7.019 | 0.237 | 750.74 |
| 0.0003 | 7.967 | 0.239 | 750.71 |
| 0.0004 | 8.970 | 0.271 | 750.70 |
| 0.0004 | 10.033 | 0.287 | 750.71 |
| 0.0005 | 11.154 | 0.344 | 750.64 |
| 0.0005 | 12.354 | 0.404 | 750.64 |
| 0.0007 | 13.591 | 0.546 | 750.58 |
| 0.0010 | 14.829 | 0.717 | 750.64 |
| 0.0014 | 16.470 | 1.084 | 750.63 |
| 0.0020 | 17.703 | 1.509 | 750.57 |
| 0.0030 | 18.905 | 2.218 | 750.55 |
| 0.0046 | 20.090 | 3.443 | 750.55 |
| 0.0075 | 21.228 | 5.639 | 750.54 |
| 0.0103 | 21.927 | 7.765 | 750.48 |
| 0.0143 | 22.588 | 10.710 | 750.50 |
| 0.0192 | 23.207 | 14.412 | 750.46 |
| 0.0250 | 23.778 | 18.769 | 750.46 |
| 0.0290 | 24.102 | 21.792 | 750.45 |
| 0.0333 | 24.431 | 24.992 | 750.41 |
| 0.0385 | 24.751 | 28.894 | 750.31 |
| 0.0436 | 25.063 | 32.682 | 750.33 |
| 0.0486 | 25.362 | 36.486 | 750.32 |
| 0.0541 | 25.652 | 40.552 | 750.26 |
| 0.0578 | 25.853 | 43.387 | 750.25 |
| 0.0620 | 26.059 | 46.498 | 750.17 |
| 0.0710 | 26.461 | 53.287 | 750.20 |
| 0.0802 | 26.840 | 60.139 | 750.15 |
| 0.1008 | 27.566 | 75.572 | 750.09 |
| 0.1169 | 28.074 | 87.651 | 750.06 |
| 0.1339 | 28.594 | 100.457 | 750.04 |

To Page No.

| Witnessed & Understood by me, | Date | Invented by | Date |
|---|---|---|---|
| | | Recorded by | |



From Page No. 31 May 05 MR cont.

| | | | |
|---|---|---|---|
| 0.1551 | 29.175 | 116.327 | 750.07 |
| 0.1786 | 29.784 | 133.954 | 749.99 |
| 0.1966 | 30.227 | 147.499 | 750.08 |
| 0.2362 | 31.122 | 177.124 | 749.98 |
| 0.2783 | 32.047 | 208.711 | 750.02 |
| 0.3145 | 32.835 | 235.899 | 749.99 |
| 0.3582 | 33.760 | 268.638 | 749.94 |
| 0.4001 | 34.609 | 300.078 | 749.97 |
| 0.4421 | 35.436 | 331.588 | 749.95 |

31 May 05 MR

To Page No.

| Witnessed & Understood by me, | Date | Invented by | Date |
|---|---|---|---|
| | | Recorded by | |

Project No.
Book No.
TITLE

From Page No. 31 May 05 MR cont.

During surface area analysis the sample tube containing the montmorillonite aliquout slipped 31 May 05 MR spilled out of the knurled nut. The sample was disgarded. The surface area analyses process will be started again for montmorillonite from the initial stage of aliquot removal from ~~montmorillonit~~ 31 May 05 MR montmorillonite 061/94.

see initial entry: 710/60 SAZ*Na*<2*FD*Scr

Surface Area Analyses of Montmorillonite

initial, before outgassing

| Sample ID | Surface Area Analyses Sample ID | Mass(g) of tube, cap and insert | Aliquot Mass(g) |
|---|---|---|---|
| Montmorillonite 710/60 | MONT2 | 28.6461 | 1.0362 |

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by



TITLE
Project No.
Book No.

From Page No. 31 May 05 MR cont.

See initial entry: 710/60 and entry 710/70

Surface Area Analyses of Montmorillonite After Outgassing

After outgassing

| Sample ID | Surface Area Analyses Sample ID | Total Mass(g) | Outgassed Sample Mass(g)* |
|---|---|---|---|
| Montmorillonite 710/60 | MONT2 | 29.5032 | 0.8571 |

*calculation

1 June 05 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by

From Page No. 1 June 05 MR

Sample ID: montmorillonite (710/60)
Surface area analyses ID: Mont2
Mass (g) before outgassing: 710/70
Mass (g) after outgassing: 710/71

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | MONT2 | Start Date | 03/02/04 |
| Customer | CNWRA | Start Time | 02:58:37 |
| Operator | MR | Elapsed Time | 1 hrs 3 min |
| Sample Wt | 0.8571 g | Outgas Time | 180 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 59.385 sq.m/g |
| Micropore Surface Area | 46.318 sq.m/g |
| Micropore Volume | 0.02055 ml/g |
| Correlation Coefficient | 0.99905 |

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | MONT2 | Start Date | 03/02/04 |
| Customer | CNWRA | Start Time | 02:58:37 |
| Operator | MR | Elapsed Time | 1 hrs 3 min |
| Sample Wt | 0.8571 g | Outgas Time | 180 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 59.385 sq.m/g |
| Total Surface Area | 105.703 sq.m/g |
| Micropore Surface Area | 46.318 sq.m/g |
| Micropore Volume | 0.02055 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 38.3872 |
| Intercept | 13.28532 |
| Correlation Coefficient | 0.99905 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3533 | 26.738 |
| 0.3681 | 27.383 |
| 0.3790 | 27.842 |
| 0.3929 | 28.411 |
| 0.4069 | 28.985 |
| 0.4218 | 29.551 |
| 0.4364 | 30.092 |
| 0.4590 | 30.894 |
| 0.4856 | 31.816 |

To Page No.

Witnessed & Understood by me, Date Invented by Date Recorded by



From Page No. 1 June 05 MR cont.

| | | | |
|---|---|---|---|
| Sample ID | MONT2 | Start Date | 03/02/04 |
| Customer | CNWRA | Start Time | 02:58:37 |
| Operator | MR | Elapsed Time | 1 hrs 3 min |
| Sample Wt | 0.8571 g | Outgas Time | 180 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0191 |
| Intercept | 0.0020 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 741.03 |
| 0.0000 | 0.523 | 0.014 | 741.01 |
| 0.0000 | 1.041 | 0.031 | 741.00 |
| 0.0001 | 1.647 | 0.047 | 741.09 |
| 0.0001 | 2.320 | 0.096 | 741.13 |
| 0.0001 | 3.069 | 0.102 | 741.21 |
| 0.0002 | 3.903 | 0.131 | 741.20 |
| 0.0002 | 4.641 | 0.133 | 741.37 |
| 0.0002 | 5.413 | 0.152 | 741.44 |
| 0.0002 | 6.239 | 0.152 | 741.38 |
| 0.0002 | 7.110 | 0.178 | 741.55 |
| 0.0003 | 8.034 | 0.186 | 741.58 |
| 0.0003 | 9.011 | 0.213 | 741.53 |
| 0.0003 | 10.055 | 0.235 | 741.69 |
| 0.0004 | 11.157 | 0.287 | 741.71 |
| 0.0005 | 12.328 | 0.356 | 741.88 |
| 0.0007 | 13.949 | 0.554 | 742.04 |
| 0.0010 | 15.160 | 0.733 | 742.07 |
| 0.0014 | 16.359 | 1.009 | 742.04 |
| 0.0019 | 17.561 | 1.403 | 742.28 |
| 0.0028 | 18.745 | 2.097 | 742.35 |
| 0.0044 | 19.902 | 3.238 | 742.27 |
| 0.0072 | 21.016 | 5.340 | 742.38 |
| 0.0099 | 21.703 | 7.328 | 742.57 |
| 0.0136 | 22.355 | 10.116 | 742.41 |
| 0.0183 | 22.968 | 13.592 | 742.53 |
| 0.0240 | 23.539 | 17.842 | 742.58 |
| 0.0279 | 23.865 | 20.708 | 742.53 |
| 0.0322 | 24.190 | 23.900 | 742.50 |
| 0.0370 | 24.514 | 27.455 | 742.46 |
| 0.0420 | 24.827 | 31.176 | 742.43 |
| 0.0472 | 25.127 | 35.039 | 742.39 |
| 0.0525 | 25.419 | 38.985 | 742.38 |
| 0.0564 | 25.613 | 41.845 | 742.35 |
| 0.0603 | 25.819 | 44.779 | 742.42 |
| 0.0698 | 26.249 | 51.799 | 742.37 |
| 0.0819 | 26.738 | 60.821 | 742.34 |
| 0.1004 | 27.383 | 74.509 | 742.39 |
| 0.1148 | 27.842 | 85.257 | 742.43 |
| 0.1341 | 28.411 | 99.575 | 742.38 |
| 0.1545 | 28.985 | 114.693 | 742.39 |

To Page No.

Witnessed & Understood by me, Date Invented by Date Recorded by

From Page No. 1 June 05 MR cont.

| | | | |
|---|---|---|---|
| 0.1769 | 29.551 | 131.310 | 742.32 |
| 0.1992 | 30.092 | 147.850 | 742.30 |
| 0.2344 | 30.894 | 174.020 | 742.33 |
| 0.2758 | 31.816 | 204.750 | 742.31 |
| 0.3171 | 32.688 | 235.454 | 742.42 |
| 0.3586 | 33.579 | 266.220 | 742.33 |
| 0.3977 | 34.370 | 295.235 | 742.30 |
| 0.4438 | 35.270 | 329.408 | 742.31 |

1 June 05 MR cont.

The total surface area ($m^2/g$) of NIST standards 1899 and 8005 were:

| | Actual | Expected |
|---|---|---|
| NIST 1899 | 10.639 $m^2/g$ | 10.67 ± 0.19* |
| NIST 8005 | 1.902 $m^2/g$ | 2.09 ± 0.16* |

- Actual values can be found 710/63-66.

The ~~montm~~ 1 June 05 MR montmorillonite aliquots (mont, mont2) resulted in higher than expected values:

| | Actual |
|---|---|
| Mont | 106.408 $m^2/g$ |
| Mont2 | 105.703 $m^2/g$ |

From previous tests it was expected to be around 97 $m^2/g$.

*expected values taken from NIST CofAs for NIST-1899 & NIST 8005.

To Page No.

Witnessed & Understood by me, Date Invented by Date
Recorded by



From Page No. 1 June 05 cont.

Due to the discrepancy between the actual and expected values for montmorillonite, the montmorillonite will continue to be tested.

A change in method parameter will be as follows:

outgass time: from 180 mins to 720 mins.

For further information regarding experiment goals and procedures see initial entry 710/60 and 710/18-19.

For this particular experiment the Mont2 aliquot will be re-used # original Mont2 analyses 710/70-73

Surface Area Analyses of Montmorillonite

initial, before outgassing

| Sample ID | Surface Area Analyses Sample ID | Total Mass (g) Mass (g) of tube, ~~1 June 05~~ 1 June 05 MR cap + insert | Aliquot Mass (g) |
|---|---|---|---|
| MONT2# | Mont3 | 29.5032 | 0.8571 |

1 June 05 MR

To Page No.

Witnessed & Understood by me, Date Invented by Date
Recorded by

From Page No. 2 June 05 MR cont.

The total surface area ($m^2/g$) value for 18995 was within expected range (710/74). 8005S was slightly lower than the expected value (710/74).

As further explanation, the surface area analyses results of the montmorillonite mineral may vary with outgass time and temperature. (710/74-75).

Surface Area Analyses of NLEWDP22PC0305-"interval" <#35 will be delayed until optimum outgassing time and temperature can be determined.

2 June 05 MR

Surface Area Analyses of Montmorillonite Surface

After outgassing

| Sample ID | Surface Area Analyses Sample ID | Total Mass (g) | Outgassed Aliquot Mass (g)* |
|---|---|---|---|
| Mont2 | Mont3 | 29.5045 | ~~0.8504~~ 0.8604 (2 June 05 MR) |

*calculation

2 June 05 MR

To Page No.

Witnessed & Understood by me, Date Invented by Date Recorded by



From Page No. 2 June 05 MR cont.

Sample ID: Mont2 710/75

Surface area analyses ID: Mont3

Mass (g) before outgassing: 710/75

Mass (g) after outgassing 710/76

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | MONT3 | Start Date | 03/03/04 |
| Customer | CNWRA | Start Time | 03:09:58 |
| Operator | MR | Elapsed Time | 1 hrs 8 min |
| Sample Wt | 0.8604 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 59.412 sq.m/g |
| Micropore Surface Area | 46.301 sq.m/g |
| Micropore Volume | 0.02043 ml/g |
| Correlation Coefficient | 0.99887 |

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | MONT3 | Start Date | 03/03/04 |
| Customer | CNWRA | Start Time | 03:09:58 |
| Operator | MR | Elapsed Time | 1 hrs 8 min |
| Sample Wt | 0.8604 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 59.412 sq.m/g |
| Total Surface Area | 105.714 sq.m/g |
| Micropore Surface Area | 46.301 sq.m/g |
| Micropore Volume | 0.02043 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 38.4050 |
| Intercept | 13.20498 |
| Correlation Coefficient | 0.99887 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3533 | 26.650 |
| 0.3684 | 27.323 |
| 0.3785 | 27.747 |
| 0.3936 | 28.371 |
| 0.4077 | 28.931 |
| 0.4212 | 29.468 |
| 0.4351 | 29.992 |
| 0.4614 | 30.910 |
| 0.4873 | 31.800 |

To Page No.

Witnessed & Understood by me, Date Invented by Date Recorded by

From Page No. 2 June 05 MR cont.

| | | | |
|---|---|---|---|
| Sample ID | MONT3 | Start Date | 03/03/04 |
| Customer | CNWRA | Start Time | 03:09:58 |
| Operator | MR | Elapsed Time | 1 hrs 8 min |
| Sample Wt | 0.8604 g | Outgas Time | 720 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0191 |
| Intercept | 0.0072 |
| Correlation Coefficient | 0.99998 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 743.72 |
| 0.0000 | 0.511 | 0.020 | 743.67 |
| 0.0001 | 1.032 | 0.039 | 743.68 |
| 0.0001 | 1.634 | 0.061 | 743.73 |
| 0.0002 | 2.296 | 0.123 | 743.75 |
| 0.0002 | 2.949 | 0.123 | 743.71 |
| 0.0002 | 3.781 | 0.160 | 743.76 |
| 0.0002 | 4.516 | 0.161 | 743.81 |
| 0.0003 | 5.290 | 0.186 | 743.82 |
| 0.0003 | 6.116 | 0.186 | 743.82 |
| 0.0003 | 6.985 | 0.217 | 743.85 |
| 0.0003 | 7.913 | 0.217 | 743.83 |
| 0.0003 | 8.888 | 0.247 | 743.84 |
| 0.0004 | 9.927 | 0.267 | 743.88 |
| 0.0004 | 11.016 | 0.322 | 743.89 |
| 0.0005 | 12.179 | 0.385 | 743.89 |
| 0.0008 | 13.791 | 0.580 | 743.87 |
| 0.0010 | 14.996 | 0.755 | 743.93 |
| 0.0014 | 16.194 | 1.038 | 743.92 |
| 0.0020 | 17.388 | 1.458 | 743.92 |
| 0.0028 | 18.571 | 2.119 | 743.92 |
| 0.0044 | 19.725 | 3.259 | 743.93 |
| 0.0070 | 20.839 | 5.240 | 743.90 |
| 0.0096 | 21.527 | 7.169 | 743.95 |
| 0.0132 | 22.189 | 9.831 | 743.95 |
| 0.0178 | 22.804 | 13.263 | 743.94 |
| 0.0233 | 23.378 | 17.322 | 743.90 |
| 0.0271 | 23.706 | 20.189 | 743.89 |
| 0.0314 | 24.035 | 23.364 | 743.86 |
| 0.0362 | 24.360 | 26.899 | 743.89 |
| 0.0411 | 24.674 | 30.539 | 743.89 |
| 0.0462 | 24.976 | 34.378 | 743.87 |
| 0.0515 | 25.271 | 38.296 | 743.87 |
| 0.0552 | 25.468 | 41.077 | 743.87 |
| 0.0592 | 25.670 | 44.065 | 743.80 |
| 0.0634 | 25.877 | 47.133 | 743.84 |
| 0.0698 | 26.165 | 51.882 | 743.77 |
| 0.0819 | 26.650 | 60.894 | 743.75 |
| 0.1008 | 27.323 | 74.967 | 743.77 |
| 0.1141 | 27.747 | 84.847 | 743.72 |
| 0.1353 | 28.371 | 100.595 | 743.72 |
| 0.1557 | 28.931 | 115.760 | 743.72 |

To Page No.

Witnessed & Understood by me, Date Invented by Date Recorded by



From Page No. 2 June 05 MR cont.

| | | | |
|---|---|---|---|
| 0.1760 | 29.468 | 130.894 | 743.66 |
| 0.1972 | 29.992 | 146.649 | 743.64 |
| 0.2381 | 30.910 | 177.030 | 743.59 |
| 0.2786 | 31.800 | 207.136 | 743.56 |
| 0.3145 | 32.571 | 233.824 | 743.55 |
| 0.3583 | 33.488 | 266.423 | 743.50 |
| 0.3997 | 34.337 | 297.146 | 743.45 |
| 0.4409 | 35.161 | 327.727 | 743.38 |

2 June 05 MR

To Page No.

Witnessed & Understood by me, Date Invented by Date Recorded by

From Page No.___ 8 June 05 MR

A literature search was conducted at the request of Paul Bertetti to determine the optimal parameters (temperature and time) for Brunauer-Emmett-Teller (BET) surface area measurements using nitrogen as a carrier (N-BET). Three documents provided helpful information and are referenced at the bottom of this entry.

N-BET surface area values increase significantly as a function of outgassing temperature.[1] When outgassing temperature is elevated, humidity can be removed from the interlayer sites of clays which results in more nitrogen adsorption and therefore a higher N-BET surface area value.[1] When outgassing temperature is increased over 230°C interlayer water will continued to be released, eventually resulting in the collapse of the layer structure of the clays and producing a low BET surface area value.[2]

Studies show a stable value of N-BET surface area can be acquired for clays, quartz, and calcite with an outgassing temperature of 200°C and an outgassing time of 6 hours.[3]

This literature review information was given to Paul, who decided all 59 surface area analyses for NC-EWDP-22PC-0305 'interval' <#35 samples will be analyzed using an outgassing temperature of 200°C and an outgassing time of 6 hours. The key was to lower the outgass temperature to prevent sample damage. These parameters are different from the original ones (350°C and 12 hours) listed in the initial entry (710/18-19). The 13 NC-EWDP-22PC-0305 'interval' <#35 samples analyzed prior to this method change (710/20-59) will be re-analyzed using the new method. These 13 samples will be re-analyzed after the other 46 samples are analyzed for the first time.

References:


[1] Metz Volker, Hadas Raanan, Heike Pieper, Dirk Bosbach and Jiwchar Ganor. (2005) Towards the establishment of a reliable proxy for the reactive surface area of smectite. *Geochimica et Cosmochimica Acta* **69** (10), 2581-2591.

[2] Velde B. (1992) *Introduction to Clay Minerals.* Chapman & Hall.

[3] Clausen, Liselotte and Ida Fabricius. (2000) BET Meausurements: Outgassing of Minerals. *Journal of Colloid and Interface Science* **227**, 7-15.


8 June 05 MR

To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by



From Page No.___ 9 June 05 MR

see initial entry: 710/18-19 and 710/80
sample prefixes: NC-EWDP-22PC 0305 (1)

**Surface Area Analyses of NC EWDP 22PC 0305 <#35 Sonic Core Samples Prior to outgassing**

Before outgassing

| Sample ID (1) | Surface Area Analyses Sample ID | Mass (g) of tube, cap & insert | Aliquot Mass (g) |
|---|---|---|---|
| 595.0-596.6 <#35 | 22-596 | 29.7307 | 1.7664 |
| 715.0-717.1 <#35 | 22-716 | ~~29.53~~ 29.5238 9 June 05 MR | 1.8197 |
| 753.2-754.9 <#35 | ~~22-5~~ 22-753 9 June 05 MR | 29.3490 | 1.8091 |

10 June 05 MR

To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by

From Page No. 10 June 05 MR

See initial entry: 710/18-19 and 710/80
Sample ID prefixes: NL EWDP 22PC 0305 (1)

Surface Area Analyses of NL EWDP 22PC 0305 <#35
Sonic Core Samples After Outgassing

After Outgassing

| Sample ID (2) | Surface Area Analyses Sample ID | Total Mass (g) | Outgassed Aliquot Mass (g) * |
|---|---|---|---|
| 595.0-596.6 <#35 | 22-596 | 31.3471 | 1.6164 |
| 715.0-717.1 <#35 | 22-716 | 31.2432 | 1.7194 |
| 753.2-754.9 <#35 | 22-753 | 31.0059 | 1.6569 |

* calculation

13 June 05 MR

To Page No.

Witnessed & Understood by me, Date Invented by Date
Recorded by



From Page No. 13 June 05 MR

Sample ID: NL EWDP 22PC 0305 595.0-596.6 <#35
Surface area analyses ID: 22-596
Mass (g) before outgassing: 710/81
Mass (g) after outgassing 710/82

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-596 | Start Date | 03/11/04 |
| Customer | CNWRA | Start Time | 03:27:10 |
| Operator | MR | Elapsed Time | 42 min |
| Sample Wt | 1.6164 g | Outgas Time | 0 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 14.413 sq.m/g |
| Micropore Surface Area | 5.123 sq.m/g |
| Micropore Volume | 0.00219 ml/g |
| Correlation Coefficient | 0.99956 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-596 | Start Date | 03/11/04 |
| Customer | CNWRA | Start Time | 03:27:10 |
| Operator | MR | Elapsed Time | 42 min |
| Sample Wt | 1.6164 g | Outgas Time | 0 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 14.413 sq.m/g |
| Total Surface Area | 19.536 sq.m/g |
| Micropore Surface Area | 5.123 sq.m/g |
| Micropore Volume | 0.00219 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 9.3165 |
| Intercept | 1.41303 |
| Correlation Coefficient | 0.99956 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3518 | 4.671 |
| 0.3680 | 4.837 |
| 0.3808 | 4.964 |
| 0.3951 | 5.103 |
| 0.4090 | 5.235 |
| 0.4225 | 5.361 |
| 0.4357 | 5.482 |

To Page No.

Witnessed & Understood by me, Date Invented by Date
Recorded by

From Page No. 13 June 05 MR cont.

| | |
|---|---|
| 0.4615 | 5.712 |
| 0.4874 | 5.935 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-596 | Start Date | 03/11/04 |
| Customer | CNWRA | Start Time | 03:27:10 |
| Operator | MR | Elapsed Time | 42 min |
| Sample Wt | 1.6164 g | Outgas Time | 0 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0162 |
| Intercept | 0.0034 |
| Correlation Coefficient | 0.99999 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 739.42 |
| 0.0000 | 0.273 | 0.016 | 739.47 |
| 0.0001 | 0.551 | 0.040 | 739.50 |
| 0.0001 | 0.873 | 0.066 | 739.53 |
| 0.0002 | 1.227 | 0.171 | 739.61 |
| 0.0003 | 1.573 | 0.234 | 739.65 |
| 0.0007 | 2.010 | 0.526 | 739.67 |
| 0.0014 | 2.386 | 1.018 | 739.67 |
| 0.0027 | 2.779 | 1.965 | 739.72 |
| 0.0050 | 3.176 | 3.668 | 739.77 |
| 0.0098 | 3.557 | 7.259 | 739.84 |
| 0.0181 | 3.843 | 13.360 | 739.92 |
| 0.0288 | 4.065 | 21.296 | 739.92 |
| 0.0352 | 4.168 | 26.028 | 739.97 |
| 0.0424 | 4.271 | 31.401 | 740.00 |
| 0.0509 | 4.377 | 37.680 | 740.05 |
| 0.0563 | 4.439 | 41.675 | 740.06 |
| 0.0624 | 4.503 | 46.162 | 740.10 |
| 0.0702 | 4.580 | 51.951 | 740.14 |
| 0.0801 | 4.671 | 59.314 | 740.10 |
| 0.1002 | 4.837 | 74.165 | 740.11 |
| 0.1172 | 4.964 | 86.762 | 740.12 |
| 0.1374 | 5.103 | 101.686 | 740.12 |
| 0.1577 | 5.235 | 116.731 | 740.14 |
| 0.1780 | 5.361 | 131.719 | 740.14 |
| 0.1982 | 5.482 | 146.678 | 740.16 |
| 0.2384 | 5.712 | 176.439 | 740.20 |
| 0.2787 | 5.935 | 206.264 | 740.15 |
| 0.3185 | 6.149 | 235.780 | 740.20 |
| 0.3594 | 6.366 | 266.022 | 740.18 |
| 0.3989 | 6.573 | 295.308 | 740.22 |
| 0.4403 | 6.787 | 325.913 | 740.18 |

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



From Page No. 13 June 05 MR cont

Sample ID: NCEWDP22PC0305 715.0-717.1 <#35
Surface area analyses ID: 22-716
Mass(g) before outgassing: 710/81
Mass(g) after outgassing: 716/82

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-716 | Start Date | 03/11/04 |
| Customer | CNWRA | Start Time | 05:19:07 |
| Operator | MR | Elapsed Time | 34 min |
| Sample Wt | 1.7194 g | Outgas Time | 0 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 8.769 sq.m/g |
| Micropore Surface Area | 2.331 sq.m/g |
| Micropore Volume | 0.00099 ml/g |
| Correlation Coefficient | 0.99998 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-716 | Start Date | 03/11/04 |
| Customer | CNWRA | Start Time | 05:19:07 |
| Operator | MR | Elapsed Time | 34 min |
| Sample Wt | 1.7194 g | Outgas Time | 0 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 8.769 sq.m/g |
| Total Surface Area | 11.099 sq.m/g |
| Micropore Surface Area | 2.331 sq.m/g |
| Micropore Volume | 0.00099 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 5.6682 |
| Intercept | 0.64094 |
| Correlation Coefficient | 0.99998 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3520 | 2.634 |
| 0.3681 | 2.727 |
| 0.3814 | 2.803 |
| 0.3953 | 2.883 |
| 0.4094 | 2.963 |
| 0.4231 | 3.041 |
| 0.4362 | 3.115 |

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

From Page No. 13 June 05 MR cont.

| | |
|---|---|
| 0.4620 | 3.258 |
| 0.4878 | 3.404 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-716 | Start Date | 03/11/04 |
| Customer | CNWRA | Start Time | 05:19:07 |
| Operator | MR | Elapsed Time | 34 min |
| Sample Wt | 1.7194 g | Outgas Time | 0 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0173 |
| Intercept | 0.0020 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 742.81 |
| 0.0000 | 0.261 | 0.001 | 742.81 |
| 0.0000 | 0.518 | 0.026 | 742.87 |
| 0.0002 | 0.818 | 0.141 | 742.94 |
| 0.0008 | 1.143 | 0.626 | 742.95 |
| 0.0022 | 1.446 | 1.646 | 743.01 |
| 0.0049 | 1.748 | 3.636 | 743.06 |
| 0.0110 | 2.016 | 8.200 | 743.11 |
| 0.0232 | 2.220 | 17.267 | 743.14 |
| 0.0309 | 2.302 | 22.969 | 743.18 |
| 0.0389 | 2.373 | 28.906 | 743.23 |
| 0.0484 | 2.444 | 35.997 | 743.28 |
| 0.0579 | 2.506 | 43.028 | 743.30 |
| 0.0635 | 2.541 | 47.232 | 743.32 |
| 0.0708 | 2.583 | 52.659 | 743.35 |
| 0.0804 | 2.634 | 59.759 | 743.34 |
| 0.1003 | 2.727 | 74.553 | 743.38 |
| 0.1182 | 2.803 | 87.839 | 743.39 |
| 0.1377 | 2.883 | 102.359 | 743.41 |
| 0.1582 | 2.963 | 117.627 | 743.40 |
| 0.1788 | 3.041 | 132.909 | 743.40 |
| 0.1990 | 3.115 | 147.910 | 743.43 |
| 0.2391 | 3.258 | 177.736 | 743.40 |
| 0.2792 | 3.404 | 207.587 | 743.39 |
| 0.3184 | 3.545 | 236.694 | 743.39 |
| 0.3599 | 3.696 | 267.540 | 743.36 |
| 0.3997 | 3.842 | 297.134 | 743.37 |
| 0.4396 | 3.993 | 326.739 | 743.34 |

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



From Page No. 13 June 05 MR cont.
Sample ID: NCEWDP22PC0305 753.2-754.9 <#35
Surface area analyses ID: 22-753
Mass(g) before outgassing: 710/81
Mass(g) after outgassing: 710/82

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-753 | Start Date | 03/11/04 |
| Customer | CNWRA | Start Time | 06:19:37 |
| Operator | MR | Elapsed Time | 41 min |
| Sample Wt | 1.6569 g | Outgas Time | 0 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 14.310 sq.m/g |
| Micropore Surface Area | 4.601 sq.m/g |
| Micropore Volume | 0.00197 ml/g |
| Correlation Coefficient | 0.99977 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-753 | Start Date | 03/11/04 |
| Customer | CNWRA | Start Time | 06:19:37 |
| Operator | MR | Elapsed Time | 41 min |
| Sample Wt | 1.6569 g | Outgas Time | 0 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 14.310 sq.m/g |
| Total Surface Area | 18.911 sq.m/g |
| Micropore Surface Area | 4.601 sq.m/g |
| Micropore Volume | 0.00197 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 9.2503 |
| Intercept | 1.27441 |
| Correlation Coefficient | 0.99977 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3520 | 4.518 |
| 0.3678 | 4.673 |
| 0.3807 | 4.797 |
| 0.3947 | 4.932 |
| 0.4091 | 5.068 |
| 0.4230 | 5.196 |
| 0.4363 | 5.317 |

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

From Page No.___ 13 June 05 MR cont.

| | |
|---|---|
| 0.4608 | 5.538 |
| 0.4870 | 5.765 |

Coulter SA 3100 Surface Area and Pore Size Analyzer
Analysis Report

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-753 | Start Date | 03/11/04 |
| Customer | CNWRA | Start Time | 06:19:37 |
| Operator | MR | Elapsed Time | 41 min |
| Sample Wt | 1.6569 g | Outgas Time | 0 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0173 |
| Intercept | 0.0045 |
| Correlation Coefficient | 0.99999 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 744.41 |
| 0.0000 | 0.269 | 0.009 | 744.43 |
| 0.0000 | 0.539 | 0.033 | 744.44 |
| 0.0001 | 0.852 | 0.073 | 744.45 |
| 0.0002 | 1.195 | 0.183 | 744.50 |
| 0.0003 | 1.530 | 0.246 | 744.54 |
| 0.0006 | 1.877 | 0.437 | 744.55 |
| 0.0011 | 2.247 | 0.853 | 744.59 |
| 0.0023 | 2.629 | 1.705 | 744.57 |
| 0.0044 | 3.021 | 3.246 | 744.62 |
| 0.0087 | 3.399 | 6.471 | 744.58 |
| 0.0163 | 3.684 | 12.154 | 744.55 |
| 0.0267 | 3.904 | 19.851 | 744.58 |
| 0.0330 | 4.005 | 24.577 | 744.56 |
| 0.0401 | 4.104 | 29.885 | 744.55 |
| 0.0484 | 4.205 | 35.999 | 744.55 |
| 0.0566 | 4.297 | 42.165 | 744.55 |
| 0.0618 | 4.351 | 46.031 | 744.54 |
| 0.0701 | 4.429 | 52.198 | 744.55 |
| 0.0803 | 4.518 | 59.797 | 744.53 |
| 0.1000 | 4.673 | 74.456 | 744.49 |
| 0.1172 | 4.797 | 87.231 | 744.49 |
| 0.1368 | 4.932 | 101.869 | 744.49 |
| 0.1578 | 5.068 | 117.482 | 744.42 |
| 0.1787 | 5.196 | 132.993 | 744.42 |
| 0.1991 | 5.317 | 148.233 | 744.37 |
| 0.2373 | 5.538 | 176.622 | 744.34 |
| 0.2780 | 5.765 | 206.943 | 744.29 |
| 0.3194 | 5.994 | 237.685 | 744.26 |
| 0.3587 | 6.210 | 266.993 | 744.27 |
| 0.3993 | 6.427 | 297.182 | 744.25 |
| 0.4406 | 6.649 | 327.932 | 744.25 |

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



From Page No.___ 13 June 05 MR cont.

See initial entry: 710/18-19 and 710/80

Sample ID prefixes: ~~NCEWDC22PC0305~~ ① 13 June 05 MR
NCEWDP22PC0305 ①

Surface Area Analyses of NCEWDP22PC0305 <#35 Sonic Core Samples Prior to Outgassing

Before outgassing

| Sample ID ① | Surface Area Analyses Sample ID | Mass (g) of tube, cap & insert | Aliquot Mass (g) |
|---|---|---|---|
| 513.3-515.3 <#35 | 22-514 | 29.2970 | 1.7645 |
| 630.2-631.9 <#35 | 22-631 | 29.5859 | 1.8281 |
| 756.3-758.1 <#35 | 13 June 05 MR ~~22-5~~ 22-757 | 29.1068 | 1.9597 |

14 June 05

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

Project No.
Book No.
TITLE

From Page No. 14 June 05 MR

See initial entry: 710/18-19 and 710180
Sample ID: NCEWDP22PC0305 ①

Surface area analyses of NCEWDP22PC 0305 <#35 Sonic Core Samples After Outgassing

After outgassing

| Sample ID ① | Surface Area Analyses Sample ID | Total Mass (g) | Outgassed Aliquot Mass (g)* |
|---|---|---|---|
| 513.3-515.3 <#35 | 22-514 | 30.9700 | 1.6730 |
| 630.2-631.9 <#35 | 22-631 | 31.2843 | 1.6984 |
| 756.3-758.1 <#35 | 22-757 | 30.9716 | 1.8648 |

*calculation

14 June 05 MR

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by



TITLE
Project No.
Book No.

From Page No. 15 June 05 MR

Sample ID: NCEWDP22PC0305 513.3-515.3 <#35
Surface area analyses ID: 22-514
mass(g) before outgassing: 710189
mass(g) after outgassing: 710190

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-514 | Start Date | 03/15/04 |
| Customer | CNWRA | Start Time | 02:30:15 |
| Operator | MR | Elapsed Time | 48 min |
| Sample Wt | 1.673 g | Outgas Time | 360 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 17.050 sq.m/g |
| Micropore Surface Area | 7.040 sq.m/g |
| Micropore Volume | 0.00303 ml/g |
| Correlation Coefficient | 0.99944 |

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |
| Sample ID | 22-514 | Start Date | 03/15/04 |
| Customer | CNWRA | Start Time | 02:30:15 |
| Operator | MR | Elapsed Time | 48 min |
| Sample Wt | 1.673 g | Outgas Time | 360 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 17.050 sq.m/g |
| Total Surface Area | 24.090 sq.m/g |
| Micropore Surface Area | 7.040 sq.m/g |
| Micropore Volume | 0.00303 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 11.0216 |
| Intercept | 1.95867 |
| Correlation Coefficient | 0.99944 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3518 | 5.811 |
| 0.3681 | 6.007 |
| 0.3805 | 6.155 |
| 0.3942 | 6.316 |
| 0.4088 | 6.480 |
| 0.4229 | 6.636 |
| 0.4356 | 6.771 |
| 0.4607 | 7.033 |
| 0.4871 | 7.303 |

Page No.

Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

From Page No.___ 15 June 05 MR cont.

| | | | |
|---|---|---|---|
| Customer | CNWRA | Start Time | 02:30:15 |
| Operator | MR | Elapsed Time | 48 min |
| Sample Wt | 1.673 g | Outgas Time | 360 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0179 |
| Intercept | 0.0032 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 747.23 |
| 0.0001 | 0.267 | 0.050 | 747.25 |
| 0.0002 | 0.531 | 0.124 | 747.28 |
| 0.0003 | 0.835 | 0.234 | 747.34 |
| 0.0003 | 1.148 | 0.256 | 747.34 |
| 0.0005 | 1.529 | 0.342 | 747.38 |
| 0.0005 | 1.881 | 0.403 | 747.40 |
| 0.0009 | 2.355 | 0.665 | 747.44 |
| 0.0013 | 2.743 | 0.997 | 747.57 |
| 0.0022 | 3.149 | 1.628 | 747.50 |
| 0.0035 | 3.571 | 2.636 | 747.58 |
| 0.0058 | 4.004 | 4.301 | 747.63 |
| 0.0100 | 4.427 | 7.512 | 747.73 |
| 0.0162 | 4.725 | 12.124 | 747.74 |
| 0.0246 | 4.971 | 18.386 | 747.78 |
| 0.0302 | 5.098 | 22.578 | 747.75 |
| 0.0364 | 5.219 | 27.237 | 747.83 |
| 0.0435 | 5.340 | 32.561 | 747.83 |
| 0.0509 | 5.450 | 38.048 | 747.90 |
| 0.0555 | 5.518 | 41.471 | 747.89 |
| 0.0608 | 5.589 | 45.497 | 747.93 |
| 0.0710 | 5.711 | 53.075 | 747.93 |
| 0.0801 | 5.811 | 59.896 | 747.91 |
| 0.1003 | 6.007 | 75.011 | 747.98 |
| 0.1168 | 6.155 | 87.383 | 747.97 |
| 0.1361 | 6.316 | 101.763 | 747.98 |
| 0.1573 | 6.480 | 117.637 | 747.96 |
| 0.1785 | 6.636 | 133.522 | 747.89 |
| 0.1980 | 6.771 | 148.052 | 747.89 |
| 0.2370 | 7.033 | 177.259 | 747.90 |
| 0.2782 | 7.303 | 208.030 | 747.84 |
| 0.3180 | 7.558 | 237.797 | 747.85 |
| 0.3589 | 7.821 | 268.381 | 747.84 |
| 0.3991 | 8.073 | 298.411 | 747.73 |
| 0.4412 | 8.334 | 329.916 | 747.78 |

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by



From Page No.___ 15 June 05 MR cont.
Sample ID: NC EWDP 22PC030S 630.2-631.9 <#35
Surface area analyses ID: 22-631
mass(g) before outgassing: 710/89
mass(g) after outgassing: 710/90

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |

| | | | |
|---|---|---|---|
| Sample ID | 22-631 | Start Date | 03/15/04 |
| Customer | CNWRA | Start Time | 03:47:00 |
| Operator | MR | Elapsed Time | 46 min |
| Sample Wt | 1.6984 g | Outgas Time | 360 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 13.188 sq.m/g |
| Micropore Surface Area | 4.824 sq.m/g |
| Micropore Volume | 0.00208 ml/g |
| Correlation Coefficient | 0.99981 |

| | | | |
|---|---|---|---|
| Serial No. | w46020 | Software Version | 2.13 |

| | | | |
|---|---|---|---|
| Sample ID | 22-631 | Start Date | 03/15/04 |
| Customer | CNWRA | Start Time | 03:47:00 |
| Operator | MR | Elapsed Time | 46 min |
| Sample Wt | 1.6984 g | Outgas Time | 360 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 13.188 sq.m/g |
| Total Surface Area | 18.011 sq.m/g |
| Micropore Surface Area | 4.824 sq.m/g |
| Micropore Volume | 0.00208 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 8.5247 |
| Intercept | 1.34449 |
| Correlation Coefficient | 0.99981 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3518 | 4.332 |
| 0.3687 | 4.483 |
| 0.3812 | 4.596 |
| 0.3941 | 4.711 |
| 0.4091 | 4.839 |
| 0.4232 | 4.960 |
| 0.4359 | 5.064 |
| 0.4613 | 5.274 |
| 0.4866 | 5.483 |

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by

From Page No.____ 15 June 05 MR cont.

| | | | |
|---|---|---|---|
| Operator | MR | Elapsed Time | 46 min |
| Sample Wt | 1.6984 g | Outgas Time | 360 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0164 |
| Intercept | 0.0028 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 750.14 |
| 0.0001 | 0.259 | 0.057 | 750.14 |
| 0.0001 | 0.522 | 0.100 | 750.12 |
| 0.0002 | 0.826 | 0.161 | 750.21 |
| 0.0004 | 1.159 | 0.327 | 750.24 |
| 0.0006 | 1.486 | 0.414 | 750.22 |
| 0.0011 | 1.899 | 0.796 | 750.19 |
| 0.0018 | 2.258 | 1.343 | 750.23 |
| 0.0033 | 2.623 | 2.445 | 750.25 |
| 0.0058 | 2.995 | 4.377 | 750.26 |
| 0.0112 | 3.346 | 8.429 | 750.29 |
| 0.0199 | 3.602 | 14.953 | 750.33 |
| 0.0307 | 3.799 | 23.051 | 750.29 |
| 0.0370 | 3.892 | 27.779 | 750.31 |
| 0.0443 | 3.983 | 33.266 | 750.33 |
| 0.0527 | 4.080 | 39.534 | 750.24 |
| 0.0582 | 4.137 | 43.677 | 750.26 |
| 0.0642 | 4.195 | 48.174 | 750.25 |
| 0.0704 | 4.250 | 52.781 | 750.26 |
| 0.0801 | 4.332 | 60.110 | 750.24 |
| 0.1011 | 4.483 | 75.819 | 750.19 |
| 0.1178 | 4.596 | 88.392 | 750.17 |
| 0.1360 | 4.711 | 101.995 | 750.16 |
| 0.1578 | 4.839 | 118.340 | 750.12 |
| 0.1789 | 4.960 | 134.224 | 750.12 |
| 0.1984 | 5.064 | 148.836 | 750.10 |
| 0.2379 | 5.274 | 178.461 | 750.07 |
| 0.2775 | 5.483 | 208.126 | 750.08 |
| 0.3188 | 5.697 | 239.085 | 750.04 |
| 0.3593 | 5.911 | 269.540 | 750.10 |
| 0.3994 | 6.112 | 299.554 | 750.05 |
| 0.4405 | 6.327 | 330.408 | 750.05 |

To Page No.____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by



From Page No.____ 15 June 05 MR cont.
Sample ID: NCEHDP22PC 0805 756.3-758.1 <#35
Surface area analyses ID: 22-757
mass(g) before outgassing: 710189
mass(g) after outgassing: 710190

| | | | |
|---|---|---|---|
| Serial No. | W46020 | Software Version | 2.13 |
| Sample ID | 22-757 | Start Date | 03/15/04 |
| Customer | CNWRA | Start Time | 05:41:47 |
| Operator | MR | Elapsed Time | 40 min |
| Sample Wt | 1.8648 g | Outgas Time | 360 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Summary

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 12.008 sq.m/g |
| Micropore Surface Area | 3.808 sq.m/g |
| Micropore Volume | 0.00163 ml/g |
| Correlation Coefficient | 0.99992 |

| | | | |
|---|---|---|---|
| Serial No. | W46020 | Software Version | 2.13 |
| Sample ID | 22-757 | Start Date | 03/15/04 |
| Customer | CNWRA | Start Time | 05:41:47 |
| Operator | MR | Elapsed Time | 40 min |
| Sample Wt | 1.8648 g | Outgas Time | 360 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

t-Plot Surface Area Report

| | |
|---|---|
| t-Plot Surface Area | 12.008 sq.m/g |
| Total Surface Area | 15.815 sq.m/g |
| Micropore Surface Area | 3.808 sq.m/g |
| Micropore Volume | 0.00163 ml/g |
| Film Thickness Range | 0.35 to 0.50 |
| Slope | 7.7618 |
| Intercept | 1.05593 |
| Correlation Coefficient | 0.99992 |

| Film Thickness (nm) | Vads (cc/g STP) |
|---|---|
| 0.3520 | 3.781 |
| 0.3684 | 3.914 |
| 0.3804 | 4.010 |
| 0.3949 | 4.125 |
| 0.4091 | 4.236 |
| 0.4229 | 4.342 |
| 0.4361 | 4.443 |
| 0.4611 | 4.633 |
| 0.4870 | 4.831 |

ge No.____

Witnessed & Understood by me, | Date | Invented by | Date | Recorded by

Project No.
Book No. TITLE

From Page No. 15 June 05 MR cont.

| | | | |
|---|---|---|---|
| Customer | CNWRA | Start Time | 05:41:47 |
| Operator | MR | Elapsed Time | 40 min |
| Sample Wt | 1.8648 g | Outgas Time | 360 min |
| Profile | BET5-T | Outgas Temperature | 200 C |

Isotherm Data

Freespace Calculation

| | |
|---|---|
| Slope | 0.0177 |
| Intercept | 0.0026 |
| Correlation Coefficient | 1.00000 |

Isotherm Data Table

| Ps/Po | Vads cc/g(STP) | Ps mmHg | Po mmHg |
|---|---|---|---|
| 0.0000 | 0.000 | 0.001 | 751.57 |
| 0.0001 | 0.237 | 0.038 | 751.57 |
| 0.0001 | 0.478 | 0.078 | 751.59 |
| 0.0002 | 0.757 | 0.121 | 751.51 |
| 0.0003 | 1.063 | 0.261 | 751.56 |
| 0.0005 | 1.362 | 0.364 | 751.54 |
| 0.0011 | 1.737 | 0.808 | 751.50 |
| 0.0020 | 2.060 | 1.508 | 751.48 |
| 0.0037 | 2.388 | 2.765 | 751.47 |
| 0.0069 | 2.714 | 5.190 | 751.43 |
| 0.0132 | 2.987 | 9.899 | 751.39 |
| 0.0229 | 3.197 | 17.229 | 751.39 |
| 0.0291 | 3.295 | 21.893 | 751.30 |
| 0.0361 | 3.384 | 27.113 | 751.31 |
| 0.0443 | 3.473 | 33.289 | 751.28 |
| 0.0525 | 3.554 | 39.406 | 751.23 |
| 0.0577 | 3.602 | 43.316 | 751.15 |
| 0.0637 | 3.654 | 47.813 | 751.10 |
| 0.0701 | 3.706 | 52.643 | 751.10 |
| 0.0804 | 3.781 | 60.363 | 751.04 |
| 0.1008 | 3.914 | 75.670 | 751.03 |
| 0.1168 | 4.010 | 87.702 | 751.04 |
| 0.1371 | 4.125 | 102.946 | 750.96 |
| 0.1578 | 4.236 | 118.477 | 750.89 |
| 0.1785 | 4.342 | 134.050 | 750.90 |
| 0.1989 | 4.443 | 149.307 | 750.84 |
| 0.2377 | 4.633 | 178.433 | 750.80 |
| 0.2781 | 4.831 | 208.774 | 750.79 |
| 0.3184 | 5.033 | 239.023 | 750.69 |
| 0.3595 | 5.232 | 269.890 | 750.68 |
| 0.4005 | 5.436 | 300.643 | 750.60 |
| 0.4388 | 5.625 | 329.324 | 750.54 |

20 JUNE 05 BAW
END OF SCIENTIFIC NOTE BOOK
ENTRIES CONTINUED IN SN 721

I have reviewed this scientific notebook and find it in agreement with QAP-001. There is sufficient information regarding methods used for conducting tests, acquiring and analyzing data so that another qualified individual could repeat the activity.

E. C. Pearl 7/6/2005

To Page No.

Witnessed & Understood by me, Date | Invented by | Date
Recorded by