Sample: CeriaLowSurface
Operator: Karl Magnus
Submitter:
File: C:\...\AKARLM~1\CERIAL.SMP

Started:	04.10.2013 12:00:18	Analysis Adsorptive:	N2
Completed:	04.10.2013 15:14:07	Analysis Bath Temp.:	-195.850 °C
Report Time:	04.10.2013 21:01:25	Sample Mass:	0.0766 g
Warm Free Space:	11.2905 cm^3 Measured	Cold Free Space:	32.4277 cm^3 Measured
Equilibration Interval:	5 s	Low Pressure Dose:	None
Sample Density:	1.000 g/cm^3	Automatic Degas:	No

Summary Report

Surface Area

Single point surface area at P/Po = 0.199755783: 5.6188 m^2/g

Pore Volume

Single point adsorption total pore volume of pores less than 701.584 Å diameter at P/Po = 0.970808728: 0.018074 cm^3/g

Pore Size

Adsorption average pore width (4V/A by BET): 124.4379 Å

Sample: CeriaLowSurface
Operator: Karl Magnus
Submitter:
File: C:\...\AKARLM~1\CERIAL.SMP

Started: 04.10.2013 12:00:18
Completed: 04.10.2013 15:14:07
Report Time: 04.10.2013 21:01:25
Warm Free Space: 11.2905 cm³ Measured
Equilibration Interval: 5 s
Sample Density: 1.000 g/cm³

Analysis Adsorptive: N2
Analysis Bath Temp.: -195.850 °C
Sample Mass: 0.0766 g
Cold Free Space: 32.4277 cm³ Measured
Low Pressure Dose: None
Automatic Degas: No

Validation errors exist for this report. Review the validation report for details.

Isotherm Tabular Report

Relative Pressure (P/Po)	Absolute Pressure (mmHg)	Quantity Adsorbed (cm³/g STP)	Elapsed Time (h:min)	Saturation Pressure (mmHg)
			00:47	756.067444
0.009937498	7.513313	0.9655	00:49	756.056763
0.034025308	25.725473	1.1723	00:50	756.068787
0.068597113	51.865761	1.2924	00:52	756.092468
0.079789925	60.323662	1.3371	00:53	756.031067
0.099786482	75.455116	1.3900	00:55	756.165710
0.120088237	90.798882	1.4421	00:56	756.101379
0.139989084	105.848221	1.4779	00:57	756.117676
0.159842110	120.852791	1.5323	00:59	756.076050
0.179798954	135.945908	1.5790	01:00	756.099548
0.199755783	151.027832	1.6129	01:02	756.062378
0.249287087	188.458694	1.7110	01:03	755.990601
0.299207778	226.172318	1.7948	01:05	755.903870
0.349035543	263.852997	1.8609	01:07	755.948792
0.398753160	301.474304	1.9216	01:08	756.042419
0.448707174	339.217529	1.9697	01:10	755.988647
0.498508895	376.846710	2.0128	01:11	755.947815
0.548310898	414.521332	2.0640	01:12	755.996887
0.598216072	452.272308	2.1275	01:14	756.035034
0.647968919	489.937866	2.2252	01:15	756.113220
0.698010223	527.739014	2.3571	01:16	756.062012
0.747607069	565.342163	2.5471	01:17	756.202271
0.797589594	603.074219	2.8660	01:19	756.120972
0.818810753	619.151367	3.0719	01:20	756.159302
0.848468593	641.512634	3.4621	01:21	756.082947
0.873453367	660.371582	3.9504	01:22	756.046753
0.898102397	679.095764	4.7128	01:24	756.145142
0.922974215	697.840332	5.9550	01:25	756.077820
0.947295547	716.230713	8.0207	01:27	756.079468
0.970808728	734.002502	11.6850	01:29	756.073242
0.979171856	740.254700	14.0364	01:31	756.000793
0.989064159	747.618530	17.6383	01:33	755.884766
0.993913628	751.272583	20.1389	01:35	755.873108
0.976903149	738.387451	17.1782	01:38	755.845093
0.962132361	727.216858	14.1233	01:40	755.838684
0.938623832	709.513855	10.4820	01:42	755.908630
0.926405018	700.200989	9.2680	01:43	755.825989
0.902990003	682.375061	7.4843	01:45	755.683960
0.876373982	662.244324	6.1640	01:46	755.664063
0.851408218	643.471924	5.3260	01:47	755.773682
0.826552463	624.620056	4.6805	01:49	755.693176
0.801118249	605.366638	4.1990	01:50	755.652039
0.752042861	568.330872	3.5224	01:51	755.716064
0.701855462	530.366821	3.0909	01:52	755.663879
0.651845616	492.545074	2.8164	01:54	755.616150
0.601726530	454.638733	2.6067	01:55	755.557068
0.551362520	416.594666	2.4575	01:56	755.573059
0.501282764	378.750366	2.3453	01:58	755.562317
0.451569990	341.206604	1.9801	01:59	755.600708
0.401030718	303.015717	1.8936	02:00	755.592285

Sample: CeriaLowSurface
Operator: Karl Magnus
Submitter:
File: C:\...\AKARLM~1\CERIAL.SMP

Started: 04.10.2013 12:00:18
Completed: 04.10.2013 15:14:07
Report Time: 04.10.2013 21:01:25
Warm Free Space: 11.2905 cm³ Measured
Equilibration Interval: 5 s
Sample Density: 1.000 g/cm³

Analysis Adsorptive: N2
Analysis Bath Temp.: -195.850 °C
Sample Mass: 0.0766 g
Cold Free Space: 32.4277 cm³ Measured
Low Pressure Dose: None
Automatic Degas: No

Isotherm Tabular Report

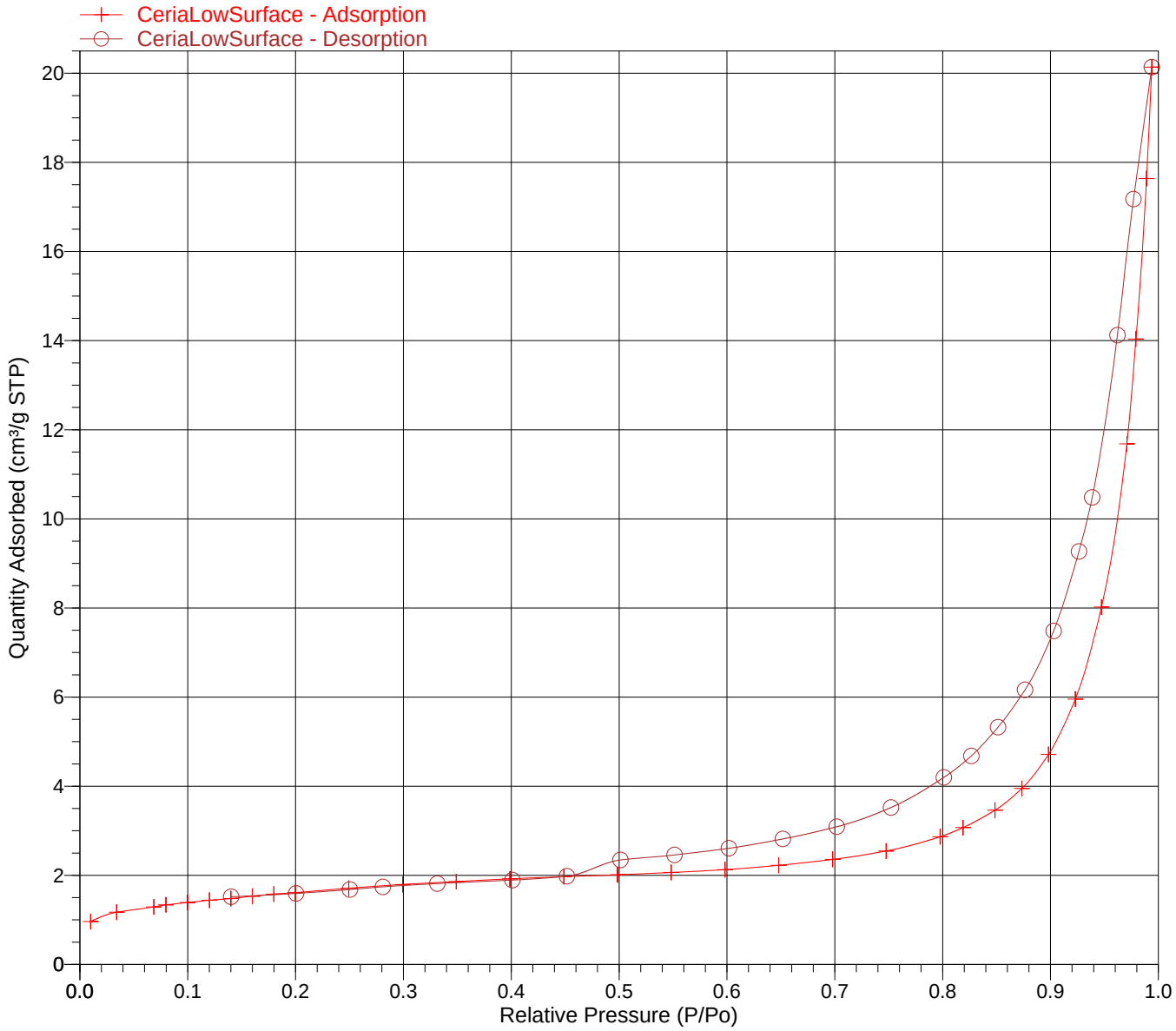
Relative Pressure (P/Po)	Absolute Pressure (mmHg)	Quantity Adsorbed (cm³/g STP)	Elapsed Time (h:min)	Saturation Pressure (mmHg)
0.331406413	250.418991	1.8149	02:02	755.625061
0.280917019	212.255920	1.7420	02:03	755.582275
0.250298355	189.122269	1.6809	02:04	755.587341
0.200424278	151.440262	1.5940	02:06	755.598389
0.140301831	105.996338	1.5197	02:07	755.487915

Sample: CeriaLowSurface
Operator: Karl Magnus
Submitter:
File: C:\...\AKARLM~1\CERIAL.SMP

Started:	04.10.2013 12:00:18	Analysis Adsorptive:	N2
Completed:	04.10.2013 15:14:07	Analysis Bath Temp.:	-195.850 °C
Report Time:	04.10.2013 21:01:25	Sample Mass:	0.0766 g
Warm Free Space:	11.2905 cm³ Measured	Cold Free Space:	32.4277 cm³ Measured
Equilibration Interval:	5 s	Low Pressure Dose:	None
Sample Density:	1.000 g/cm³	Automatic Degas:	No

Validation errors exist for this report. Review the validation report for details.

Isotherm Linear Plot



Sample: CeriaLowSurface
Operator: Karl Magnus
Submitter:
File: C:\...\AKARLM~1\CERIAL.SMP

Started:	04.10.2013 12:00:18	Analysis Adsorptive:	N2
Completed:	04.10.2013 15:14:07	Analysis Bath Temp.:	-195.850 °C
Report Time:	04.10.2013 21:01:25	Sample Mass:	0.0766 g
Warm Free Space:	11.2905 cm³ Measured	Cold Free Space:	32.4277 cm³ Measured
Equilibration Interval:	5 s	Low Pressure Dose:	None
Sample Density:	1.000 g/cm³	Automatic Degas:	No

BET Surface Area Report

BET Surface Area: 5.8099 ± 0.0268 m²/g
Slope: 0.743643 ± 0.003423 g/cm³ STP
Y-Intercept: 0.005630 ± 0.000473 g/cm³ STP
C: 133.094858
Qm: 1.3346 cm³/g STP
Correlation Coefficient: 0.9999364
Molecular Cross-Sectional Area: 0.1620 nm²

Relative Pressure (P/Po)	Quantity Adsorbed (cm³/g STP)	1/[Q(Po/P - 1)]
0.068597113	1.2924	0.056985
0.079789925	1.3371	0.064850
0.099786482	1.3900	0.079744
0.120088237	1.4421	0.094641
0.139989084	1.4779	0.110139
0.159842110	1.5323	0.124164
0.179798954	1.5790	0.138828
0.199755783	1.6129	0.154761

Sample: CeriaLowSurface
Operator: Karl Magnus
Submitter:
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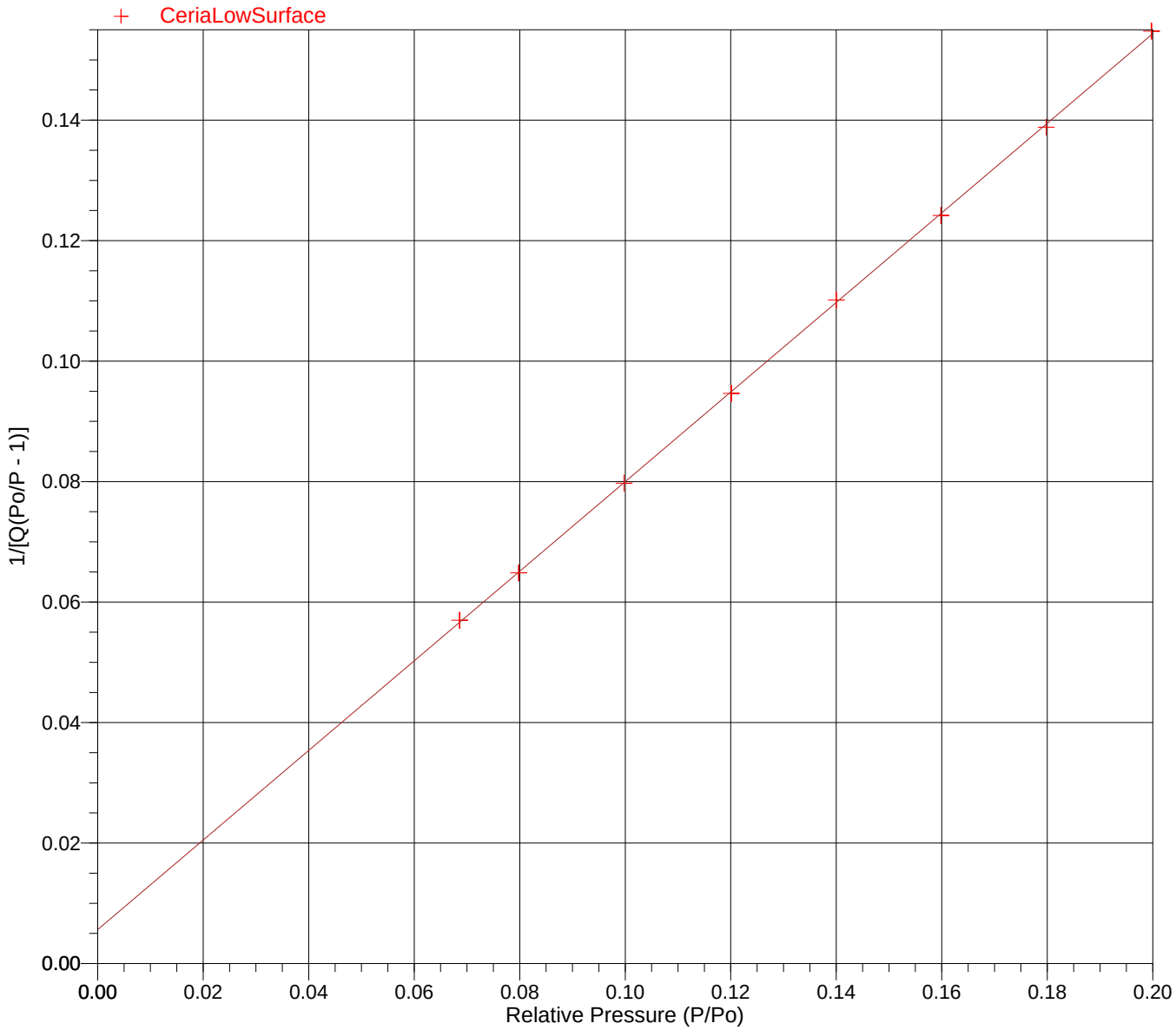
Started:	04.10.2013 12:00:18	Analysis Adsorptive:	N2
Completed:	04.10.2013 15:14:07	Analysis Bath Temp.:	-195.850 °C
Report Time:	04.10.2013 21:01:25	Sample Mass:	0.0766 g
Warm Free Space:	11.2905 cm³ Measured	Cold Free Space:	32.4277 cm³ Measured
Equilibration Interval:	5 s	Low Pressure Dose:	None
Sample Density:	1.000 g/cm³	Automatic Degas:	No

BET Surface Area Plot



Sample: CeriaLowSurface
Operator: Karl Magnus
Submitter:
File: C:\...\AKARLM~1\CERIAL.SMP

Started:	04.10.2013 12:00:18	Analysis Adsorptive:	N2
Completed:	04.10.2013 15:14:07	Analysis Bath Temp.:	-195.850 °C
Report Time:	04.10.2013 21:01:25	Sample Mass:	0.0766 g
Warm Free Space:	11.2905 cm³ Measured	Cold Free Space:	32.4277 cm³ Measured
Equilibration Interval:	5 s	Low Pressure Dose:	None
Sample Density:	1.000 g/cm³	Automatic Degas:	No

Langmuir Surface Area Report

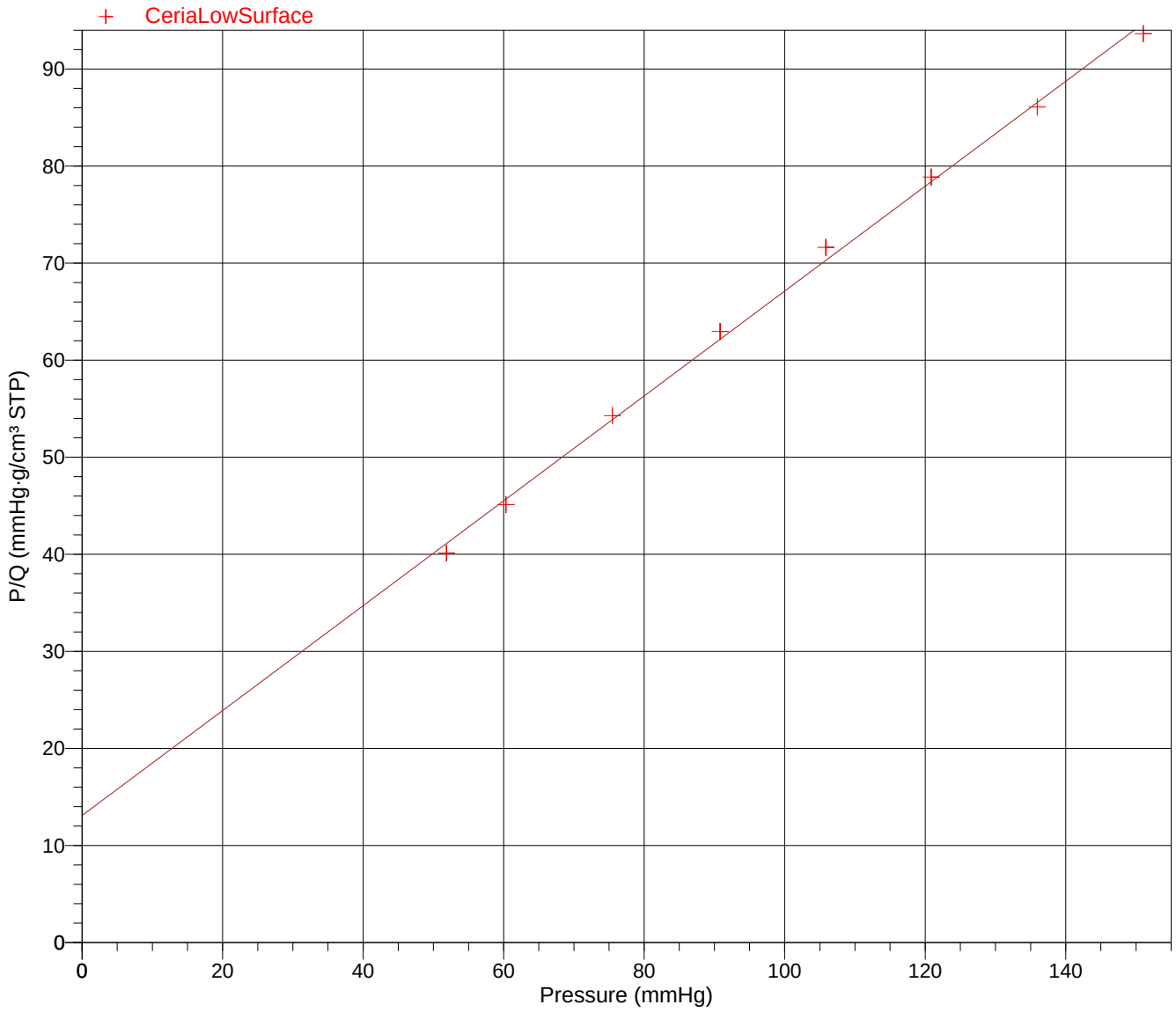
Langmuir Surface Area: 8.0571 ± 0.1507 m²/g
Slope: 0.540295 ± 0.010107 g/cm³ STP
Y-Intercept: 13.092521 ± 1.056218 mmHg·g/cm³ STP
b: 0.041267 1/mmHg
Qm: 1.8508 cm³/g STP
Correlation Coefficient: 0.998952
Molecular Cross-Sectional Area: 0.1620 nm²

Pressure (mmHg)	Quantity Adsorbed (cm³/g STP)	P/Q (mmHg·g/cm³ STP)
51.865761	1.2924	40.130
60.323662	1.3371	45.117
75.455116	1.3900	54.283
90.798882	1.4421	62.965
105.848221	1.4779	71.620
120.852791	1.5323	78.872
135.945908	1.5790	86.095
151.027832	1.6129	93.636

Sample: CeriaLowSurface
Operator: Karl Magnus
Submitter:
File: C:\...\AKARLM~1\CERIAL.SMP

Started:	04.10.2013 12:00:18	Analysis Adsorptive:	N2
Completed:	04.10.2013 15:14:07	Analysis Bath Temp.:	-195.850 °C
Report Time:	04.10.2013 21:01:25	Sample Mass:	0.0766 g
Warm Free Space:	11.2905 cm³ Measured	Cold Free Space:	32.4277 cm³ Measured
Equilibration Interval:	5 s	Low Pressure Dose:	None
Sample Density:	1.000 g/cm³	Automatic Degas:	No

Langmuir Surface Area Plot



Sample: CeriaLowSurface
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Started:	04.10.2013 12:00:18	Analysis Adsorptive:	N2
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Warm Free Space:	11.2905 cm³ Measured	Cold Free Space:	32.4277 cm³ Measured
Equilibration Interval:	5 s	Low Pressure Dose:	None
Sample Density:	1.000 g/cm³	Automatic Degas:	No

t-Plot Report

Micropore Volume:	0.000320 cm³/g
Micropore Area:	0.8301 m²/g
External Surface Area:	4.9798 m²/g
Slope:	0.321943 ± 0.005021 cm³/g·Å STP
Y-Intercept:	0.207037 ± 0.020405 cm³/g STP
Correlation Coefficient:	0.999271
Surface Area Correction Factor:	1.000
Density Conversion Factor:	0.0015468
Total Surface Area (BET):	5.8099 m²/g
Thickness Range:	3.5000 Å to 5.0000 Å
Thickness Equation:	Harkins and Jura

t = [13.99 / (0.034 - log(P/Po))] ^ 0.5

Relative Pressure (P/Po)	Statistical Thickness (Å)	Quantity Adsorbed (cm³/g STP)	Fitted
0.009937498	2.6209	0.9655	
0.034025308	3.0517	1.1723	
0.068597113	3.4177	1.2924	
0.079789925	3.5154	1.3371	*
0.099786482	3.6767	1.3900	*
0.120088237	3.8284	1.4421	*
0.139989084	3.9694	1.4779	*
0.159842110	4.1048	1.5323	*
0.179798954	4.2372	1.5790	*
0.199755783	4.3673	1.6129	*
0.249287087	4.6853	1.7110	*
0.299207778	5.0070	1.7948	
0.349035543	5.3372	1.8609	
0.398753160	5.6822	1.9216	
0.448707174	6.0514	1.9697	
0.498508895	6.4495	2.0128	
0.548310898	6.8868	2.0640	
0.598216072	7.3760	2.1275	
0.647968919	7.9304	2.2252	

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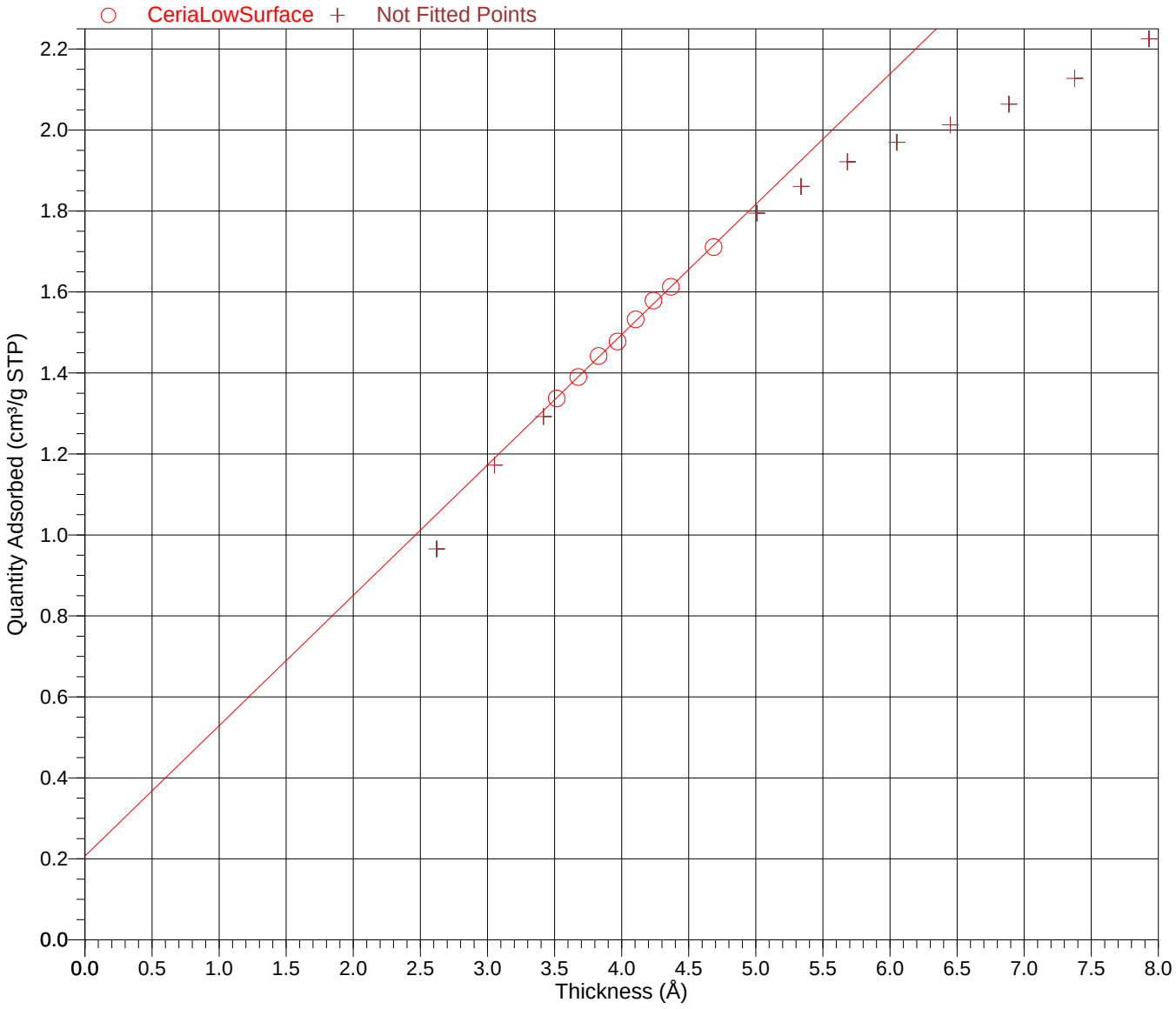
Equilibration Interval:	5 s	Low Pressure Dose:	None
Sample Density:	1.000 g/cm³	Automatic Degas:	No

t-Plot

Harkins and Jura



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Equilibration Interval: 5 s
Sample Density: 1.000 g/cm³

Analysis Adsorptive: N2
Analysis Bath Temp.: -195.850 °C
Sample Mass: 0.0766 g
Cold Free Space: 32.4277 cm³ Measured
Low Pressure Dose: None
Automatic Degas: No

BJH Adsorption Pore Distribution Report

Faas Correction
Broekhoff-De Boer
$\log(P/Po) = -16.11 / t^2 + 0.1682 \exp\{ -0.1137 t \}$

Diameter Range: 17.000 Å to 3000.000 Å
Adsorbate Property Factor: 9.53000 Å
Density Conversion Factor: 0.0015468
Fraction of Pores Open at Both Ends: 0.00

Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm³/g)	Cumulative Pore Volume (cm³/g)	Incremental Pore Area (m²/g)	Cumulative Pore Area (m²/g)
3273.8 - 1842.9	2181.6	0.004288	0.004288	0.079	0.079
1842.9 - 976.8	1164.1	0.006158	0.010446	0.212	0.290
976.8 - 698.1	791.8	0.003935	0.014381	0.199	0.489
698.1 - 388.1	459.4	0.006158	0.020538	0.536	1.025
388.1 - 266.7	304.8	0.003478	0.024016	0.456	1.482
266.7 - 202.2	225.3	0.002072	0.026088	0.368	1.850
202.2 - 163.1	178.3	0.001236	0.027324	0.277	2.127
163.1 - 136.2	147.1	0.000746	0.028070	0.203	2.330
136.2 - 113.7	122.8	0.000556	0.028626	0.181	2.511
113.7 - 101.6	106.9	0.000273	0.028899	0.102	2.613
101.6 - 80.8	88.6	0.000356	0.029255	0.161	2.774
80.8 - 66.7	72.3	0.000138	0.029393	0.076	2.850
66.7 - 56.3	60.6	0.000050	0.029442	0.033	2.883
56.3 - 48.4	51.7	0.000006	0.029449	0.005	2.888
48.4 - 26.4	27.9	0.000005	0.029454	0.007	2.895
26.4 - 23.5	24.8	0.000029	0.029483	0.047	2.942
23.5 - 20.8	22.0	0.000091	0.029574	0.166	3.108
20.8 - 18.3	19.4	0.000136	0.029711	0.282	3.390
18.3 - 17.3	17.8	0.000030	0.029740	0.067	3.457

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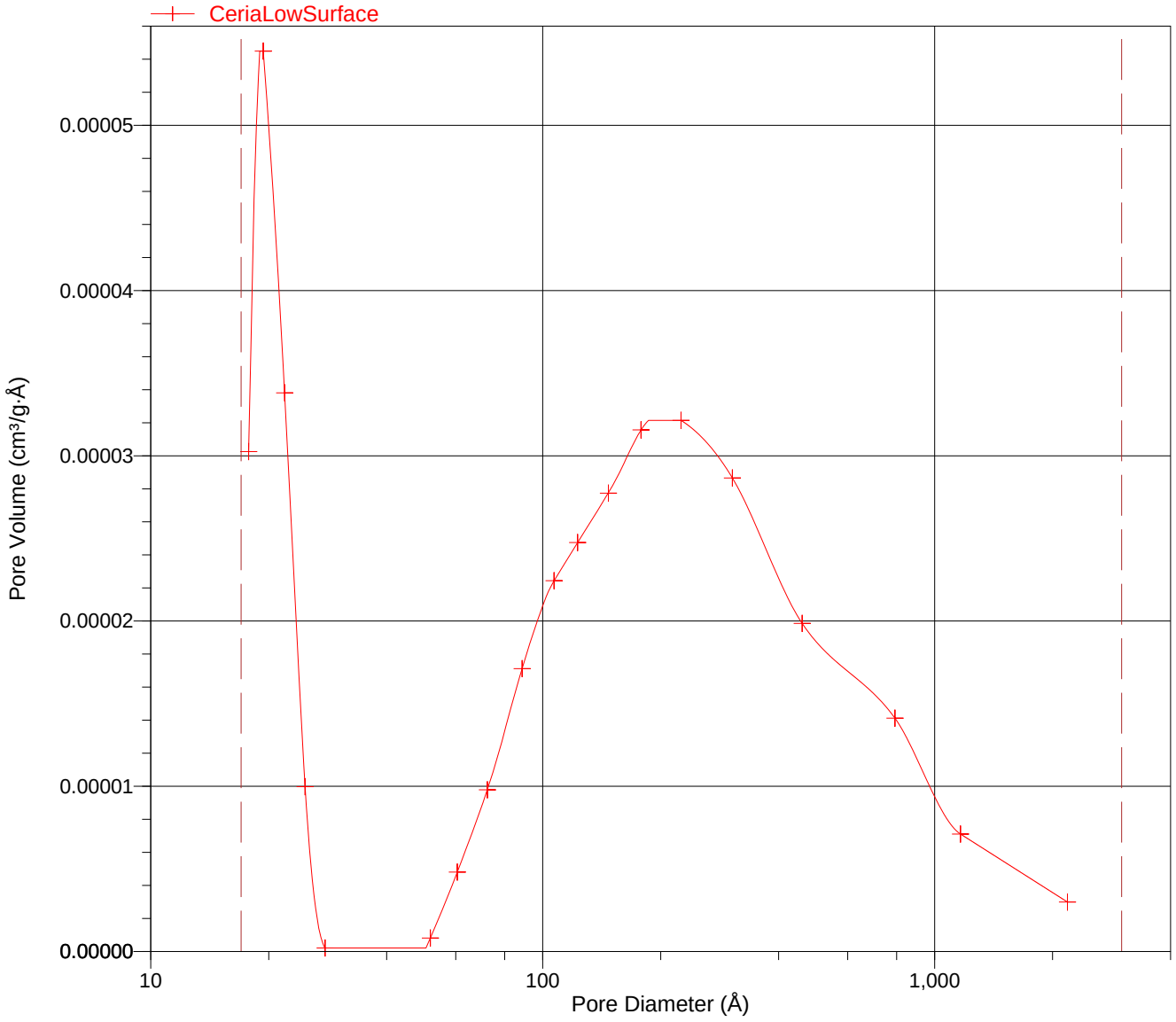
Completed:	04.10.2013 15:14:07	Analysis Bath Temp.:	-195.850 °C
Report Time:	04.10.2013 21:01:25	Sample Mass:	0.0766 g
Warm Free Space:	11.2905 cm³ Measured	Cold Free Space:	32.4277 cm³ Measured
Equilibration Interval:	5 s	Low Pressure Dose:	None
Sample Density:	1.000 g/cm³	Automatic Degas:	No

BJH Adsorption dV/dD Pore Volume

Broekhoff-De Boer : Faas Correction



Sample: CeriaLowSurface
Operator: Karl Magnus
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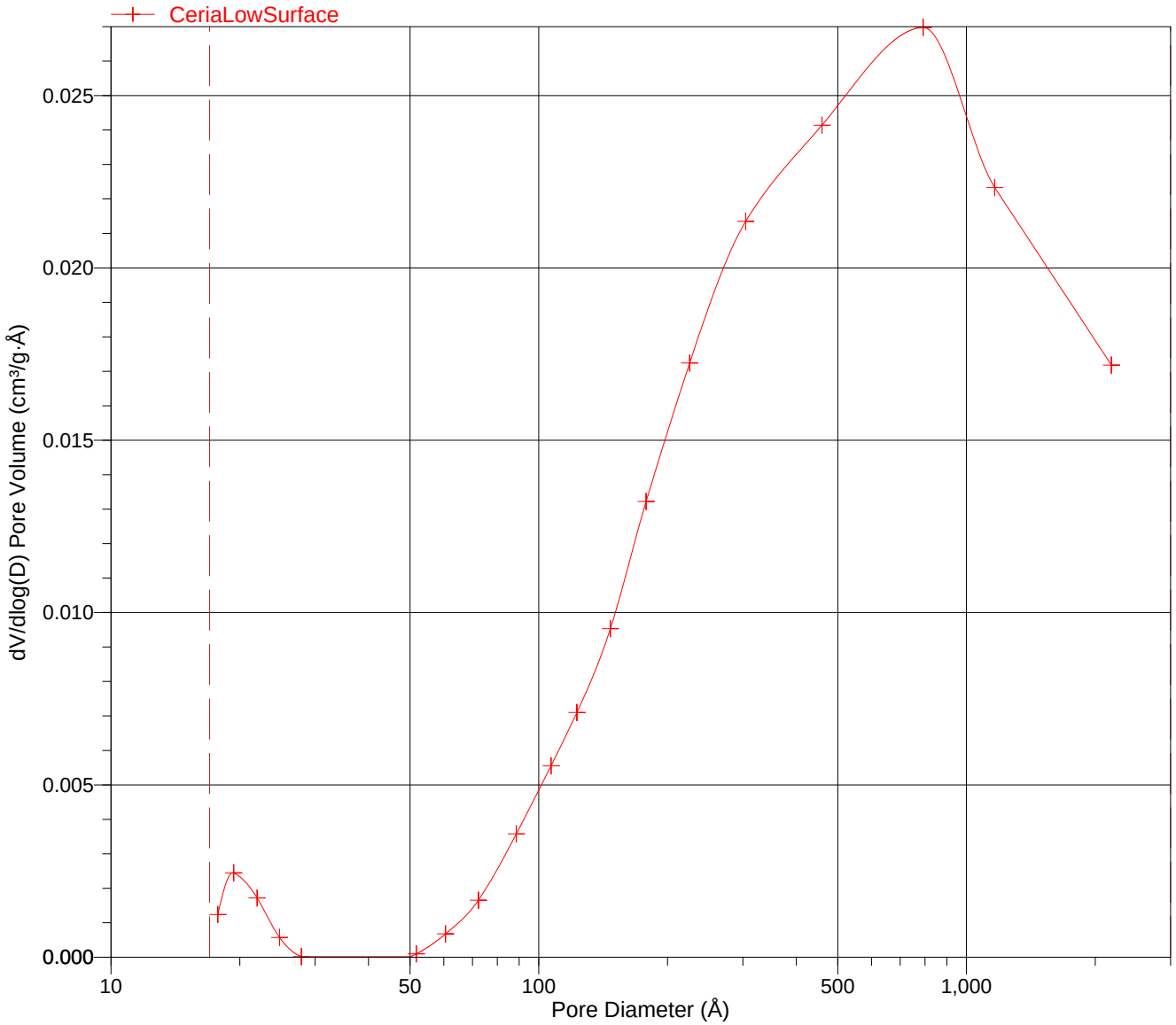
File: C:\...\AKARLM~1\CERIAL.SMP

Started:	04.10.2013 12:00:18	Analysis Adsorptive:	N2
Completed:	04.10.2013 15:14:07	Analysis Bath Temp.:	-195.850 °C
Report Time:	04.10.2013 21:01:25	Sample Mass:	0.0766 g
Warm Free Space:	11.2905 cm³ Measured	Cold Free Space:	32.4277 cm³ Measured
Equilibration Interval:	5 s	Low Pressure Dose:	None
Sample Density:	1.000 g/cm³	Automatic Degas:	No

BJH Adsorption dV/dlog(D) Pore Volume

Broekhoff-De Boer : Faas Correction



Sample: CeriaLowSurface
Operator: Karl Magnus
Submitter:
File: C:\...\AKARLM~1\CERIAL.SMP

Started:	04.10.2013 12:00:18	Analysis Adsorptive:	N2
Completed:	04.10.2013 15:14:07	Analysis Bath Temp.:	-195.850 °C
Report Time:	04.10.2013 21:01:25	Sample Mass:	0.0766 g
Warm Free Space:	11.2905 cm³ Measured	Cold Free Space:	32.4277 cm³ Measured
Equilibration Interval:	5 s	Low Pressure Dose:	None
Sample Density:	1.000 g/cm³	Automatic Degas:	No

BJH Desorption Pore Distribution Report

Faas Correction
Broekhoff-De Boer
$\log(P/Po) = -16.11 / t^2 + 0.1682 \exp\{ -0.1137 t \}$

Diameter Range: 17.000 Å to 3000.000 Å
Adsorbate Property Factor: 9.53000 Å
Density Conversion Factor: 0.0015468
Fraction of Pores Open at Both Ends: 0.00

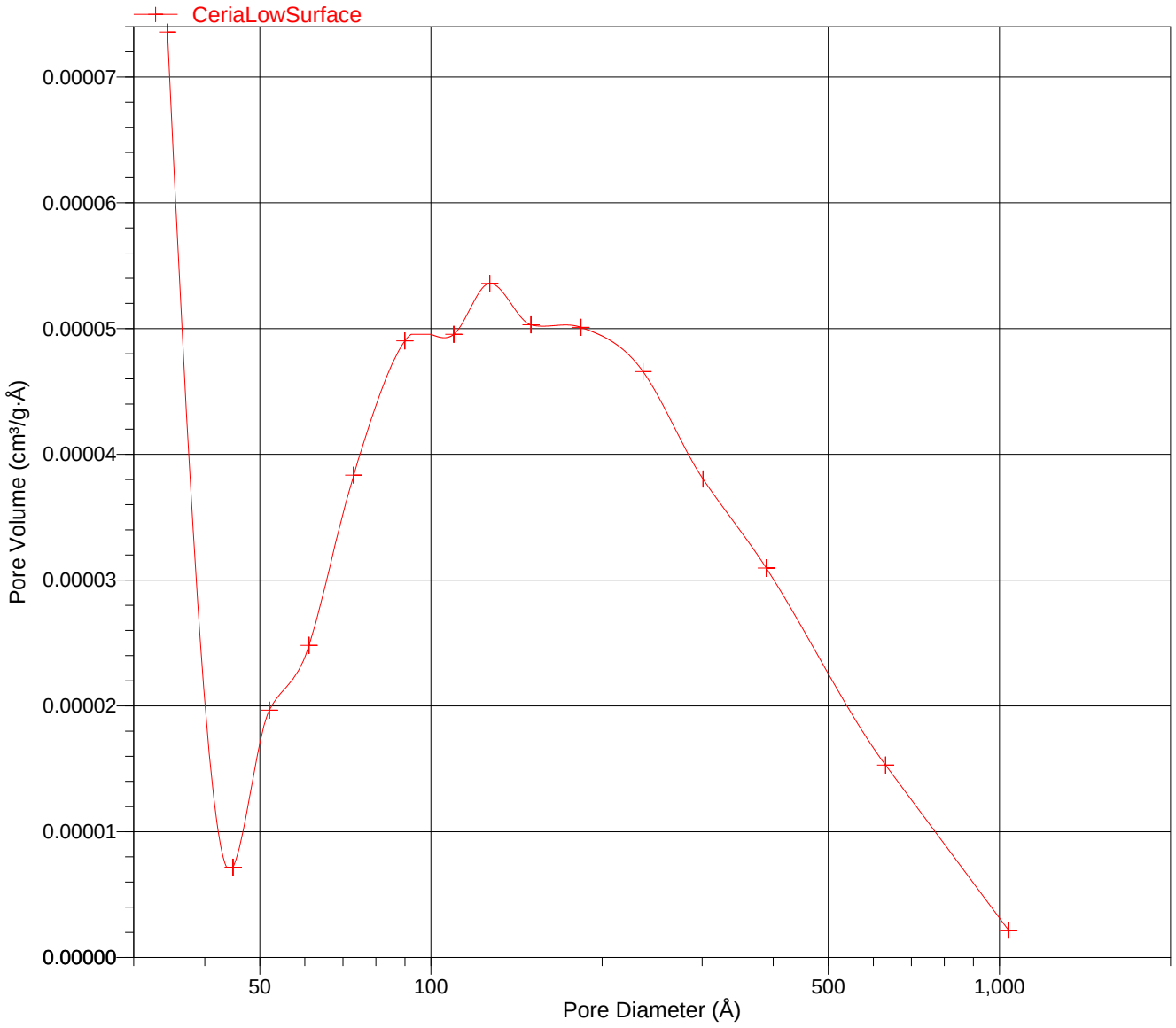
Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm³/g)	Cumulative Pore Volume (cm³/g)	Incremental Pore Area (m²/g)	Cumulative Pore Area (m²/g)
3273.5 - 881.2	1037.3	0.005218	0.005218	0.201	0.201
881.2 - 538.4	630.4	0.005243	0.010461	0.333	0.534
538.4 - 333.5	388.9	0.006344	0.016805	0.652	1.186
333.5 - 278.7	301.0	0.002085	0.018890	0.277	1.464
278.7 - 212.0	236.0	0.003105	0.021996	0.526	1.990
212.0 - 166.6	183.6	0.002274	0.024270	0.495	2.485
166.6 - 138.6	149.9	0.001409	0.025679	0.376	2.861
138.6 - 118.5	126.9	0.001074	0.026754	0.339	3.200
118.5 - 103.1	109.7	0.000765	0.027519	0.279	3.479
103.1 - 82.0	90.0	0.001035	0.028554	0.460	3.939
82.0 - 67.3	73.1	0.000562	0.029116	0.308	4.247
67.3 - 56.7	61.0	0.000263	0.029380	0.172	4.419
56.7 - 48.6	52.0	0.000160	0.029539	0.123	4.542
48.6 - 42.1	44.9	0.000046	0.029586	0.041	4.584
42.1 - 32.5	34.4	0.000708	0.030293	0.823	5.407

Sample: CeriaLowSurface
Operator: Karl Magnus
Submitter:
File: C:\...\AKARLM~1\CERIAL.SMP

Started:	04.10.2013 12:00:18	Analysis Adsorptive:	N2
Completed:	04.10.2013 15:14:07	Analysis Bath Temp.:	-195.850 °C
Report Time:	04.10.2013 21:01:25	Sample Mass:	0.0766 g
Warm Free Space:	11.2905 cm³ Measured	Cold Free Space:	32.4277 cm³ Measured
Equilibration Interval:	5 s	Low Pressure Dose:	None
Sample Density:	1.000 g/cm³	Automatic Degas:	No

BJH Desorption dV/dD Pore Volume

Broekhoff-De Boer : Faas Correction



Sample: CeriaLowSurface
Operator: Karl Magnus
Submitter:
File: C:\...\AKARLM~1\CERIAL.SMP

Started:	04.10.2013 12:00:18	Analysis Adsorptive:	N2
Completed:	04.10.2013 15:14:07	Analysis Bath Temp.:	-195.850 °C
Report Time:	04.10.2013 21:01:25	Sample Mass:	0.0766 g
Warm Free Space:	11.2905 cm³ Measured	Cold Free Space:	32.4277 cm³ Measured
Equilibration Interval:	5 s	Low Pressure Dose:	None
Sample Density:	1.000 g/cm³	Automatic Degas:	No

Options Report

Sample Tube

Warm free space:	3.7700 cm³
Cold free space:	3.7700 cm³
Non-ideality factor:	0.0000620
Use Isothermal Jacket:	Yes
Use Filler Rod:	No
Vacuum seal type:	None

Analysis Conditions

Preparation

Fast evacuation:	No
Evacuation rate:	5.0 mmHg/s
Unrestricted evacuation from:	5.0 mmHg
Evacuation time:	0.10 h
Leak test:	Yes
Leak test duration:	120 s
Use TranSeal:	No

Free Space

Free-space type:	Measured
Lower dewar for evacuation:	Yes
Evacuation time:	0.20 h
Outgas test:	No

Po and Temperature

Po and T type:	Measure Po in the Po tube for each isotherm point. Enter the Analysis Bath Temperature below.
Temperature:	-195.850 °C

Dosing

Use first pressure fixed dose:	No
Use maximum volume increment:	No
Target tolerance:	5.0% or 5.000 mmHg

Equilibration

Equilibration interval:	5 s
Minimum equilibration delay at P/Po >= 0.995:	600 s

Sample Backfill

Backfill at start of analysis:	Yes
Backfill at end of analysis:	Yes
Backfill gas:	N2

Adsorptive Properties

Adsorptive:	Nitrogen
Maximum manifold pressure:	1050.00 mmHg
Non-ideality factor:	0.0000620
Density conversion factor:	0.0015468
Molecular cross-sectional area:	0.162 nm²

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Validation Report

Isotherm Reports

Free Space: Low free space values may be observed when using liquid argon or ice baths.

Po: Passed

Pressure/Volume Adsorbed: Passed

Desorption: Not within limits. Increase the sample mass, increase the equilibration interval, or check the free space.