



GAS PHYSISORPTION ISOTHERM DEGASSING CONDITIONS

SAMPLE ID	EXTERNAL DEGASSING CONDITIONS			IN-SITU VACUUM DEGASSING CONDITIONS	
	DURATION	TEMPERATURE	TECHNIQUE	DURATION	TEMPERATURE
Fe₂O₃					
2019_07	24 Hours	110°C	Vacuum	1 Hour	110°C

GAS PHYSISORPTION ISOTHERM DATA SUMMARY

SAMPLE ID	BET SPECIFIC SURFACE AREA (m ² /g)	BJH PORE VOLUME 1.7 – 300 nm (cm ³ /g)	BJH AVG PORE DIAMETER 1.7 – 300 nm (nm)	ADSORBATE GAS
Fe₂O₃				
2019_07	246.64	0.22	3.67	Nitrogen

GAS PHYSISORPTION ISOTHERM DATA SUMMARY (continued)

SAMPLE ID	DFT PORE VOLUME		DFT PORE AREA	
	TOTAL VOLUME (cm ³ /g)	PORE SIZE RANGE (nm)	TOTAL AREA (m ² /g)	PORE SIZE RANGE (nm)
Fe₂O₃				
2019_07	0.18	≤ 38.734	186.96	≥ 0.844

JP 2019-07-24

2019-07-24



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INTERPRETING YOUR MICRO-MESOPORE ANALYSIS BY GAS PHYSISORPTION (STATIC VOLUMETRIC METHOD)

INTRODUCTION

The pore size distribution analysis of your sample(s) has been conducted on a static pressure (volumetric) analyzer using the gas adsorption technique. The amount of inert gas adsorbed to the surface of a sample is measured at varying relative pressures by this technique. As relative pressure increases to near saturation pressures (adsorption), accessible pores of increasing size fill with condensed gas. Analysis of micropores (pore diameter < 2 nm) requires a lower relative pressure range than for mesopores (pore diameter 2-50 nm) using nitrogen gas. As a result, argon (Ar) or carbon dioxide (CO₂) are frequently used as the adsorbate gases for micropore analyses.

Various theories can be applied to obtain different parameters. The surface area can be determined using the Brunauer–Emmett–Teller (BET) theory. The Barrett, Joyner, and Halenda (BJH) theory is used to determine the cylindrical equivalent pore volumes and pore areas for pore diameters around 2 - 300 nm, though it cannot be applied to micropores. The Density Functional Theory (DFT) or Non-Local Density Functional Theory (NLDFT) may be applied to characterize both microporosity and mesoporosity. The model used for your sample(s) was chosen based on the sample type, pore geometry (e.g. cylindrical or slit-shaped) and adsorbate gas required for the analysis.

THE DATA

The header section contains various user-entered information specific to each project. It generally includes the client name, sample identification, and analysis notes. Each project is given its own unique seven digit code (PTL Project #) which can be found on these data pages. Please refer to this PTL Project # when contacting us with any questions regarding the analysis.

The first data page contains the summary report, which includes information about both surface area and pore size distribution. Commonly reported values are explained below:

- **BET Specific Surface Area:** the surface area calculated based on the BET model normalized by the sample mass.
- **BJH Adsorption/Desorption Cumulative Volume of Pores:** the cumulative volume found in pores normalized for the sample mass. Typically, the BJH desorption values are reported as this is an equilibrium process, though the adsorption or desorption branch of the isotherm may provide different information based on the type of isotherm and hysteresis generated.
- **BJH Adsorption/Desorption Average Pore Diameter:** assuming cylindrical pore geometry, the volume of gas adsorbed at each pressure yields the volume weighted pore diameter distribution. The average pore diameter is derived from the distribution.
- **(NL)DFT Total Volume in Pores:** the cumulative volume found in pores based on the (NL)DFT model in the pore size range reported. The adsorption branch is used for the calculations since the (NL)DFT model uses molecular based statistics. The incremental and cumulative volumes of pores can also be found on the (NL)DFT Tabular Report.
- **(NL)DFT Total Area in Pores:** the cumulative area of pores based on the (NL)DFT model in the pore size range reported, similar to the total volume in pores.

The remaining data pages include the tabular results, isotherm plot, the BET transform, the BJH results, and the (NL)DFT results. This document focuses only on the (NL)DFT plots. Commonly used referenced plots are explained below:

- **(NL)DFT Cumulative Surface Area vs. Pore Width:** the plot of the cumulative surface area versus the pore width. The differential plot of the incremental surface area divided by the difference in pore width ($\Delta A/\Delta W$) from each increment step is also overlaid on this plot. This set of plots is helpful for viewing which pore size ranges contribute to the overall surface area.
- **(NL)DFT $dA/d\log(W)$ Surface Area vs. Pore Width:** Y-axis is the incremental surface area divided by the difference in log pore width ($\Delta A/\Delta \log W$) from each intrusion step. The volume vs. log pore width ($\Delta V/\Delta \log W$) may also be overlaid on this plot. This calculation compensates for the compression or amplification effects which may be exhibited by the differential plots.
- **(NL)DFT Cumulative Pore Volume vs. Pore Width:** the plot of the cumulative pore volume versus the pore width, similar to the cumulative surface area plot.
- **(NL)DFT Pore Size Log Goodness of Fit and Pore Size Goodness of Fit:** both plots illustrate the data fit of the chosen (NL)DFT model. If carbon dioxide and nitrogen data sets were blended together, the log plot is useful for visualizing how well data from the different adsorbate gases fit together.

For additional questions specific to your sample results, please contact us directly.



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Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

Started: 7/23/2019 11:27:52 AM	Analysis adsorptive: N2
Completed: 7/24/2019 3:19:44 AM	Analysis bath temp.: 77.207 K
Report time: 7/24/2019 2:37:01 PM	Thermal correction: No
Sample mass: 0.6583 g	Ambient free space: 15.1981 cm ³ Measured
Analysis free space: 53.7130 cm ³	Equilibration interval: 20 to 30 s
Low pressure dose: 0.5000 cm ³ /g STP	Sample density: 1.000 g/cm ³
Automatic degas: No	

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

Summary Report

Surface Area

Single point surface area at $p/p^\circ = 0.298608702$: 232.0066 m²/g

BET Surface Area: 246.6409 m²/g

Pore Volume

BJH Adsorption cumulative volume of pores
between 1.7000 nm and 300.0000 nm diameter: 0.163572 cm³/g

BJH Desorption cumulative volume of pores
between 1.7000 nm and 300.0000 nm diameter: 0.221245 cm³/g

Pore Size

BJH Adsorption average pore diameter (4V/A): 4.1414 nm

BJH Desorption average pore diameter (4V/A): 3.6674 nm

DFT Pore Size

Volume in Pores	<	0.844 nm	:	0.00000 cm ³ /g
Total Volume in Pores	<=	38.734 nm	:	0.17822 cm ³ /g
Area in Pores	>	38.734 nm	:	4.777 m ² /g
Total Area in Pores	>=	0.844 nm	:	186.963 m ² /g

JP 7/24

CP 2019-07-24



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Isotherm Tabular Report

Relative Pressure (p/p°)	Absolute Pressure (mmHg)	Quantity Adsorbed (cm ³ /g STP)	Elapsed Time (h:min)	Saturation Pressure (mmHg)
			02:12	746.484985
0.000002701	0.002019	0.4539	02:40	747.388367
0.000039688	0.029658	10.1589	02:56	747.276184
0.000361911	0.270428	19.9247	03:13	747.222961
0.003431412	2.563629	29.2189	03:30	747.106201
0.019163488	14.315284	36.4581	03:42	747.008240
0.025551458	19.086754	37.8876	03:51	746.992737
0.048462365	36.200943	41.7701	04:01	746.990845
0.077563279	57.938984	45.8419	04:10	746.989868
0.105188634	78.557465	49.5602	04:21	746.824646
0.122916721	91.788437	51.9669	04:30	746.753052
0.146295786	109.254539	55.2235	04:39	746.805786
0.170267523	127.145226	58.6348	04:48	746.737976
0.194697088	145.390930	62.1529	04:59	746.754517
0.219842513	164.181137	65.7087	05:09	746.812500
0.245566158	183.366531	69.2384	05:19	746.709290
0.271773457	202.942566	72.6726	05:29	746.734314
0.298608702	222.980927	75.9965	05:39	746.732849
0.326056357	243.487381	79.1529	05:49	746.764709
0.354648644	264.812164	82.2111	05:59	746.688782
0.398966313	297.899872	86.4551	06:10	746.679260
0.448331869	334.756195	90.4760	06:20	746.670532
0.497864192	371.721985	93.8295	06:29	746.633301
0.547759549	408.989929	96.6361	06:38	746.659607
0.598276746	446.657593	98.9808	06:46	746.573547
0.648102023	483.875763	100.9772	06:53	746.604309
0.698319094	521.359009	102.8252	07:01	746.591370
0.747443664	558.008301	104.6730	07:08	746.555664
0.797451620	595.283081	106.8149	07:15	746.481750
0.823768428	614.899841	108.1146	07:22	746.447449
0.848512084	633.325867	109.5401	07:29	746.395813
0.873190491	651.774719	111.2292	07:37	746.429016
0.897245574	669.761292	113.3674	07:46	746.463745
0.921839300	688.179932	116.3057	07:55	746.529175



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Isotherm Tabular Report

Relative Pressure (p/p°)	Absolute Pressure (mmHg)	Quantity Adsorbed (cm ³ /g STP)	Elapsed Time (h:min)	Saturation Pressure (mmHg)
0.944972955	705.455994	120.5036	08:07	746.535645
0.961273897	717.635437	125.1217	08:19	746.546265
0.972629762	726.087708	129.9018	08:31	746.520142
0.981515257	732.735046	135.3512	08:45	746.534546
0.987834436	737.424194	140.0899	08:59	746.505859
0.992720166	741.122681	144.3424	09:13	746.557495
0.983820410	734.570374	141.5208	09:22	746.650879
0.976065540	728.814270	138.3906	09:34	746.685791
0.965372885	720.854492	134.3690	09:47	746.710938
0.949837584	709.356262	129.6600	09:59	746.818481
0.924814961	690.695435	124.1016	10:13	746.847168
0.902448124	674.130676	120.7574	10:24	747.002136
0.878129266	656.044189	118.0708	10:33	747.092957
0.852763848	637.012512	115.8431	10:42	746.997559
0.826625571	617.490967	114.0254	10:50	747.002014
0.801860829	598.958374	112.5436	10:58	746.960510
0.749836912	560.125061	109.9995	11:06	746.995850
0.702409311	524.747986	108.0273	11:13	747.068665
0.652472917	487.448761	106.0988	11:21	747.078918
0.601788440	449.608948	104.1455	11:29	747.121277
0.552269156	412.603577	102.0184	11:37	747.105957
0.504518119	376.905212	99.1943	11:48	747.059814
0.448730109	335.187286	92.1004	12:12	746.968567
0.401639289	300.010895	86.9401	12:26	746.966003
0.353578223	264.078735	82.1345	12:37	746.875000
0.328011662	245.002289	79.4047	12:47	746.931641
0.301405779	225.118530	76.3537	12:57	746.895203
0.276341783	206.383240	73.2806	13:08	746.840515
0.251208109	187.612885	70.0307	13:18	746.842468
0.226244892	168.958923	66.6409	13:28	746.796631
0.201164301	150.228577	63.1048	13:38	746.795410
0.178302569	133.155899	59.8266	13:48	746.797424
0.150155732	112.129517	55.8108	13:59	746.754822
0.125221627	93.507484	52.3241	14:10	746.735901



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Relative Pressure (p/p°)	Absolute Pressure (mmHg)	Quantity Adsorbed (cm ³ /g STP)	Elapsed Time (h:min)	Saturation Pressure (mmHg)
0.100391058	74.973015	48.9502	14:19	746.809692
0.078052515	58.291523	45.9468	14:28	746.824402
0.050637646	37.819420	42.1421	14:38	746.863708



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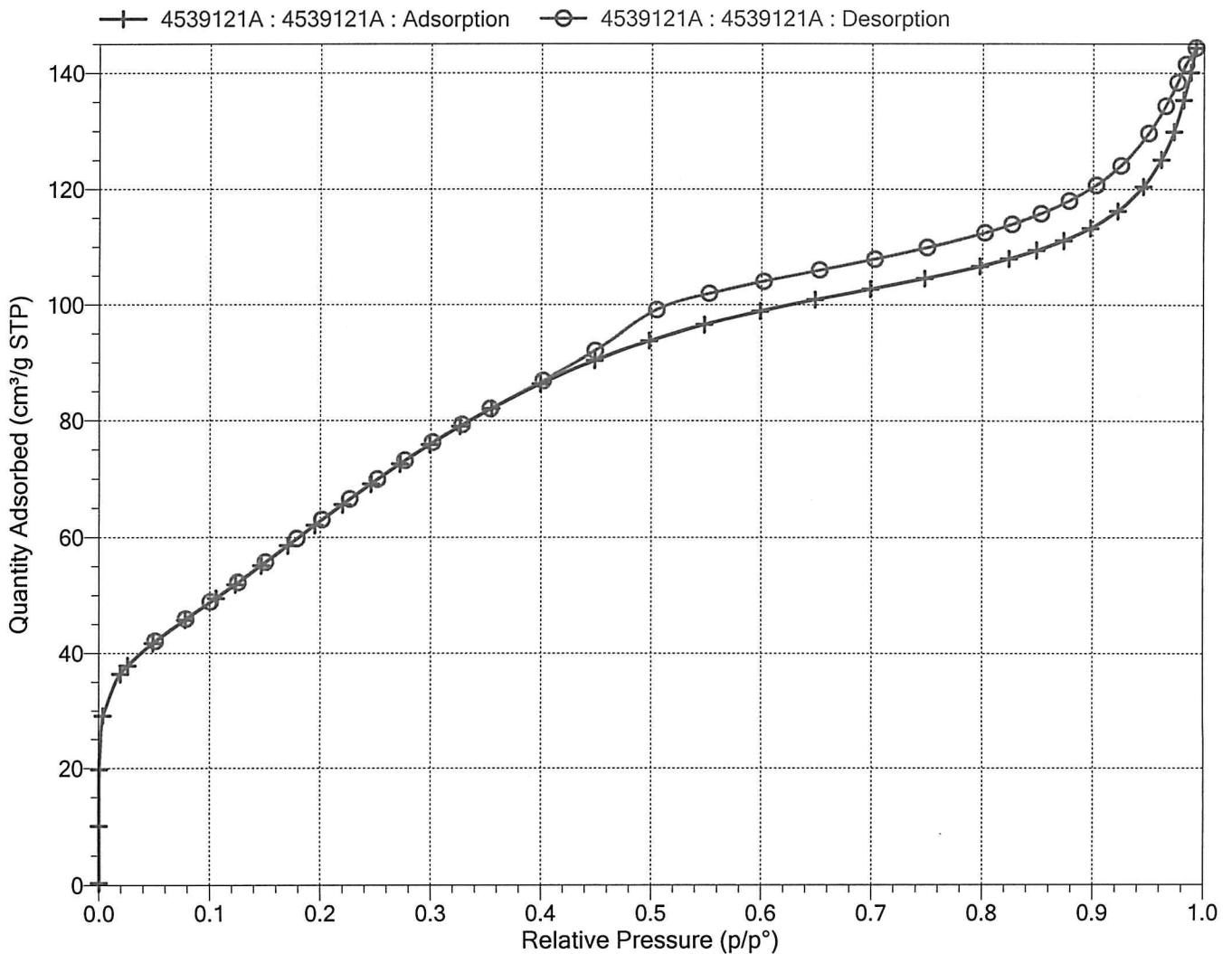
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Isotherm Linear Plot





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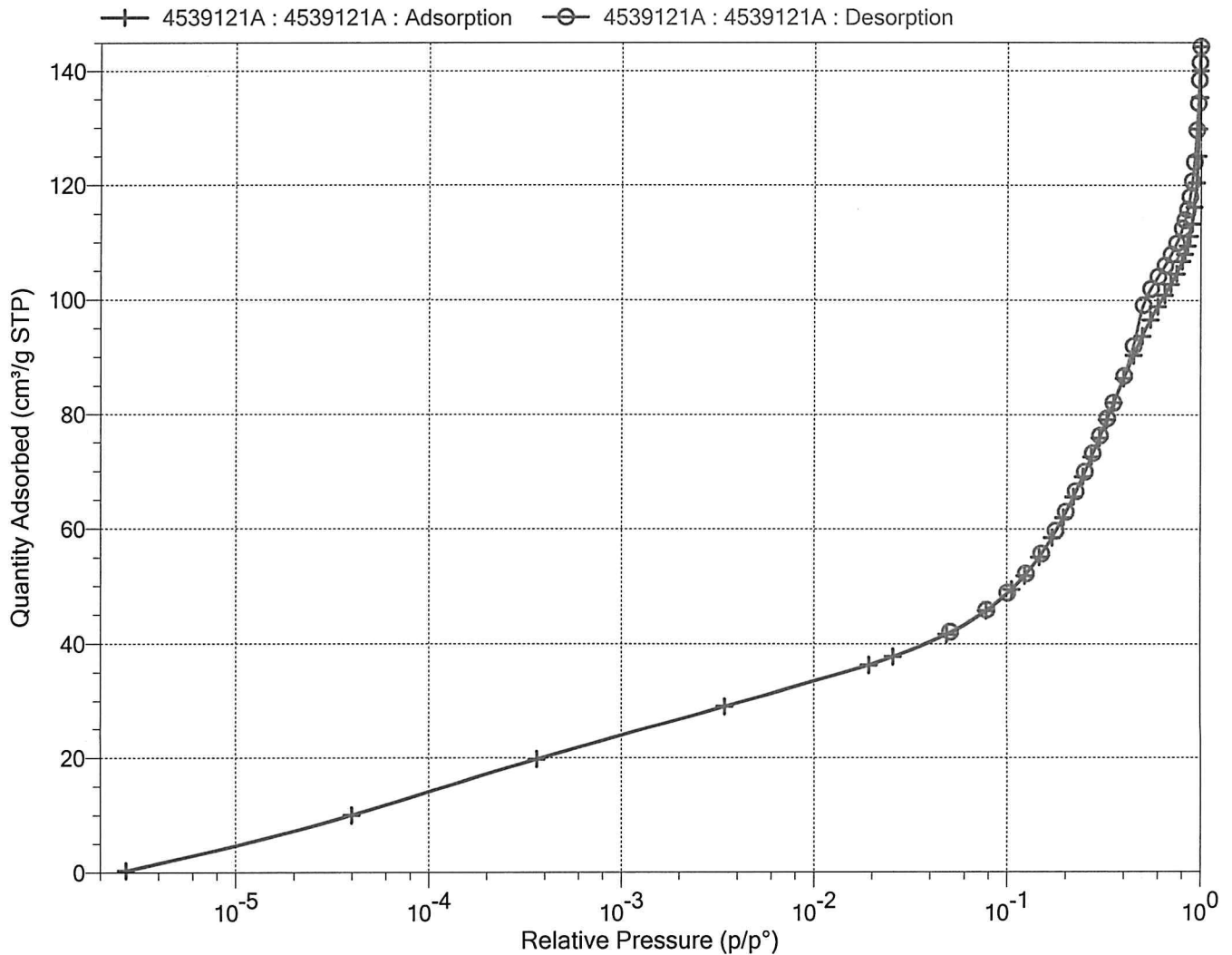
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Isotherm Log Plot





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BET Report

BET surface area: 246.6409 ± 3.6527 m²/g
Slope: 0.017121 ± 0.000257 g/cm³ STP
Y-intercept: 0.000527 ± 0.000049 g/cm³ STP
C: 33.514309
Qm: 56.6655 cm³/g STP
Correlation coefficient: 0.9989892
Molecular cross-sectional area: 0.1620 nm²

Relative Pressure (p/p°)	Quantity Adsorbed (cm ³ /g STP)	1/[Q(p°/p - 1)]
0.048462365	41.7701	0.001219
0.077563279	45.8419	0.001834
0.105188634	49.5602	0.002372
0.122916721	51.9669	0.002697
0.146295786	55.2235	0.003103
0.170267523	58.6348	0.003500
0.194697088	62.1529	0.003890
0.219842513	65.7087	0.004289
0.245566158	69.2384	0.004701
0.271773457	72.6726	0.005135
0.298608702	75.9965	0.005602



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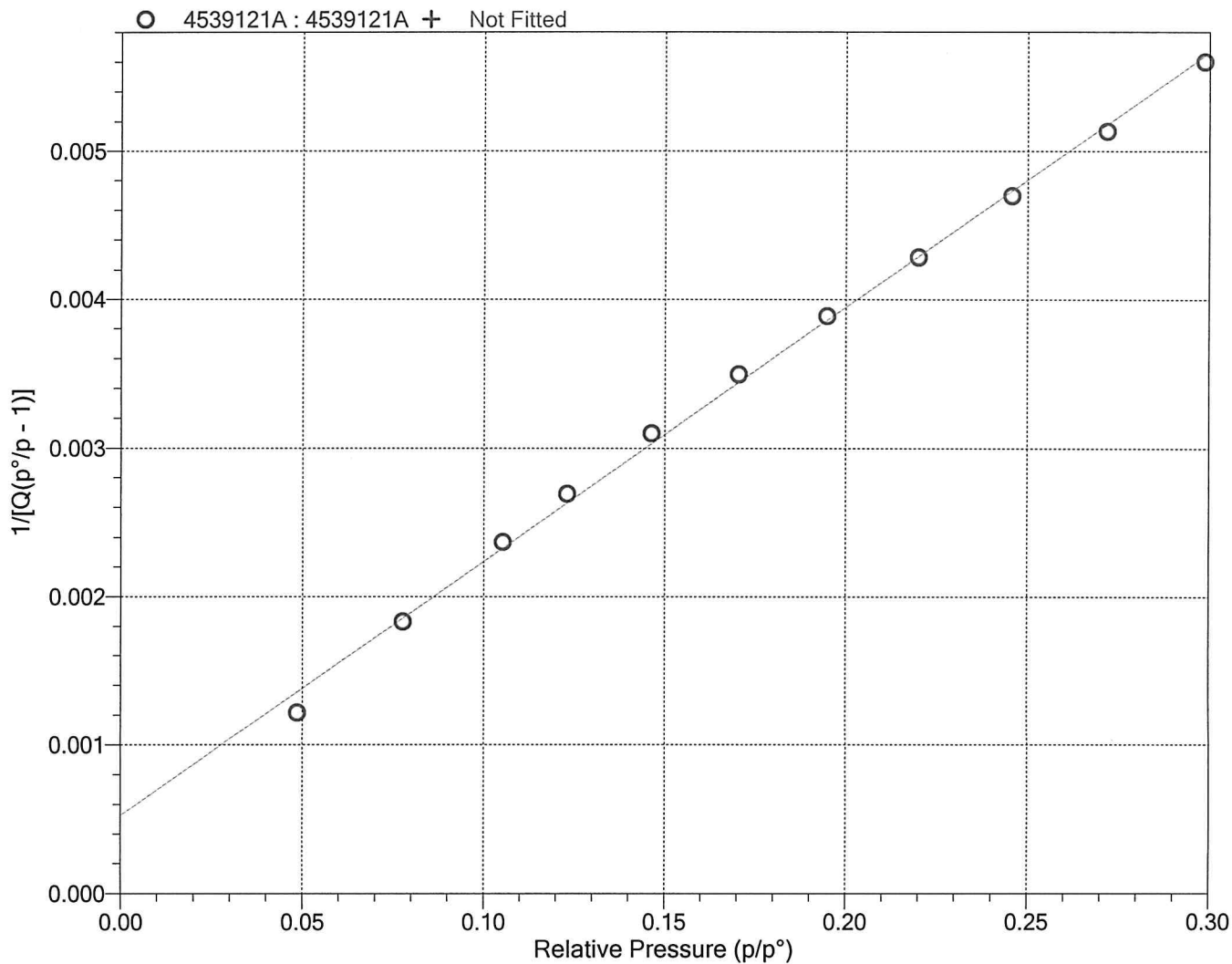
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BET Surface Area Plot





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BJH Adsorption Pore Distribution Report

Faas Correction

Halsey

$$t = 3.54 [-5 / \ln(p/p^0)] ^ 0.333$$

Diameter range: 1.7000 nm to 300.0000 nm

Adsorbate property factor: 0.95300 nm

Density conversion factor: 0.0015492

Fraction of pores open at both ends: 0.00

Pore Diameter Range (nm)	Average Diameter (nm)	Incremental Pore Volume (cm ³ /g)	Cumulative Pore Volume (cm ³ /g)	Incremental Pore Area (m ² /g)	Cumulative Pore Area (m ² /g)
266.6 - 160.4	188.4	0.006931	0.006931	0.147	0.147
160.4 - 106.2	122.5	0.007798	0.014729	0.255	0.402
106.2 - 72.2	82.8	0.009079	0.023807	0.439	0.840
72.2 - 51.3	58.2	0.008042	0.031849	0.553	1.393
51.3 - 36.3	41.2	0.007857	0.039706	0.762	2.155
36.3 - 25.7	29.2	0.007214	0.046920	0.989	3.145
25.7 - 19.6	21.8	0.005067	0.051988	0.930	4.075
19.6 - 15.9	17.3	0.003705	0.055693	0.855	4.929
15.9 - 13.3	14.4	0.002929	0.058622	0.816	5.746
13.3 - 11.4	12.2	0.002491	0.061112	0.817	6.562
11.4 - 9.9	10.5	0.002285	0.063397	0.868	7.430
9.9 - 7.9	8.6	0.003846	0.067243	1.783	9.213
7.9 - 6.5	7.0	0.003384	0.070627	1.924	11.137
6.5 - 5.5	5.9	0.003505	0.074133	2.379	13.516
5.5 - 4.7	5.0	0.003976	0.078109	3.163	16.679
4.7 - 4.1	4.3	0.004908	0.083017	4.516	21.196
4.1 - 3.6	3.8	0.006154	0.089172	6.483	27.679
3.6 - 3.2	3.3	0.007616	0.096787	9.110	36.788
3.2 - 2.8	3.0	0.009388	0.106175	12.688	49.476
2.8 - 2.5	2.6	0.010087	0.116262	15.255	64.731
2.5 - 2.4	2.4	0.007314	0.123576	12.047	76.777
2.4 - 2.2	2.3	0.007553	0.131129	13.318	90.095
2.2 - 2.1	2.1	0.007948	0.139077	14.983	105.078
2.1 - 1.9	2.0	0.008145	0.147222	16.417	121.495
1.9 - 1.8	1.9	0.008249	0.155471	17.786	139.281



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Sample mass: 0.6583 g	Ambient free space: 15.1981 cm ³ Measured
Analysis free space: 53.7130 cm ³	Equilibration interval: 20 to 30 s
Low pressure dose: 0.5000 cm ³ /g STP	Sample density: 1.000 g/cm ³
Automatic degas: No	

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

Pore Diameter Range (nm)	Average Diameter (nm)	Incremental Pore Volume (cm ³ /g)	Cumulative Pore Volume (cm ³ /g)	Incremental Pore Area (m ² /g)	Cumulative Pore Area (m ² /g)
1.8 - 1.7	1.7	0.008101	0.163572	18.706	157.987



Particle Technology Labs

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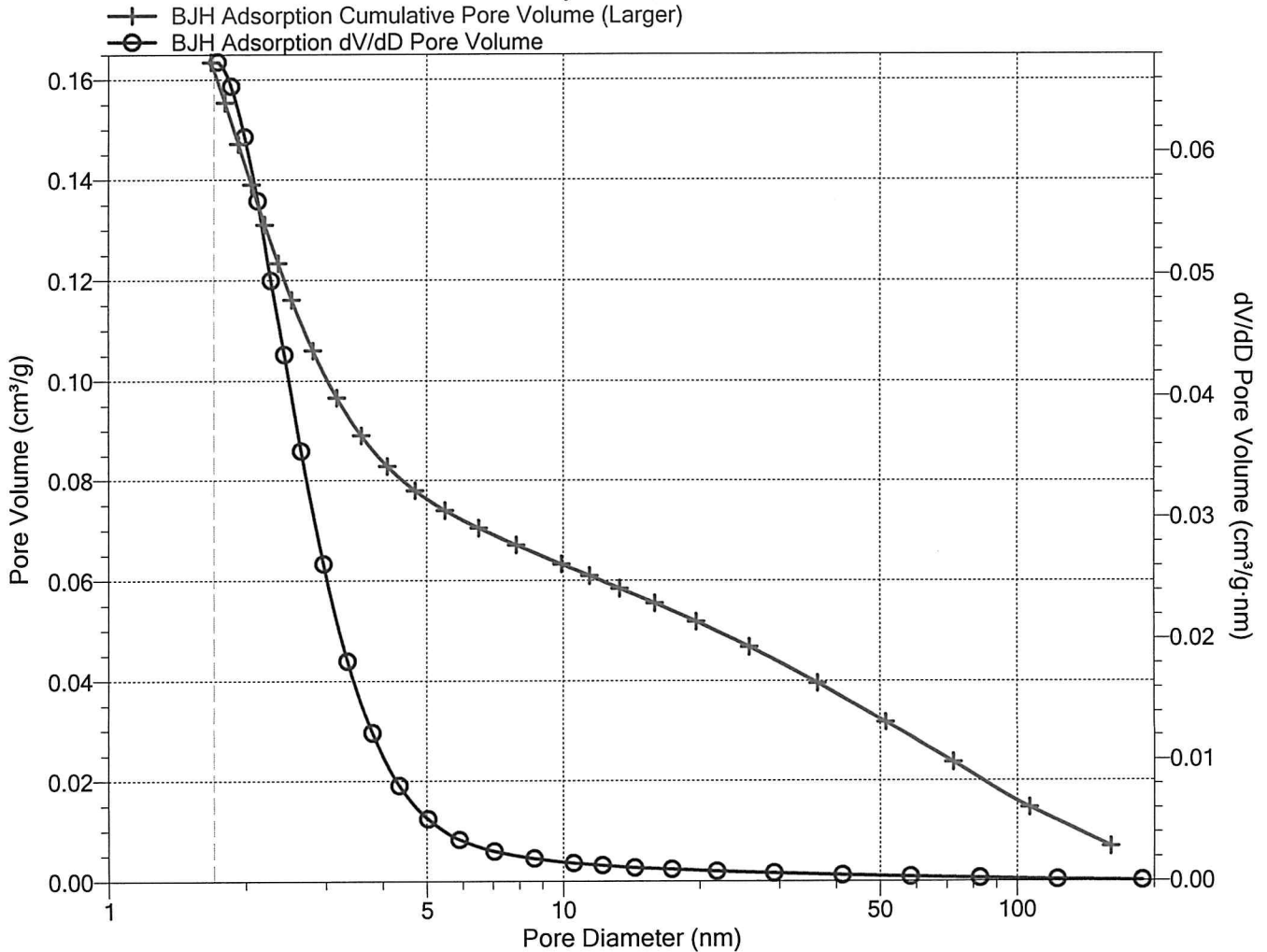
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Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

Started: 7/23/2019 11:27:52 AM	Analysis adsorptive: N2
Completed: 7/24/2019 3:19:44 AM	Analysis bath temp.: 77.207 K
Report time: 7/24/2019 2:37:01 PM	Thermal correction: No
Sample mass: 0.6583 g	Ambient free space: 15.1981 cm ³ Measured
Analysis free space: 53.7130 cm ³	Equilibration interval: 20 to 30 s
Low pressure dose: 0.5000 cm ³ /g STP	Sample density: 1.000 g/cm ³
Automatic degas: No	

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

BJH Adsorption Cumulative Pore Volume (Larger)

Halsey : Faas Correction





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Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

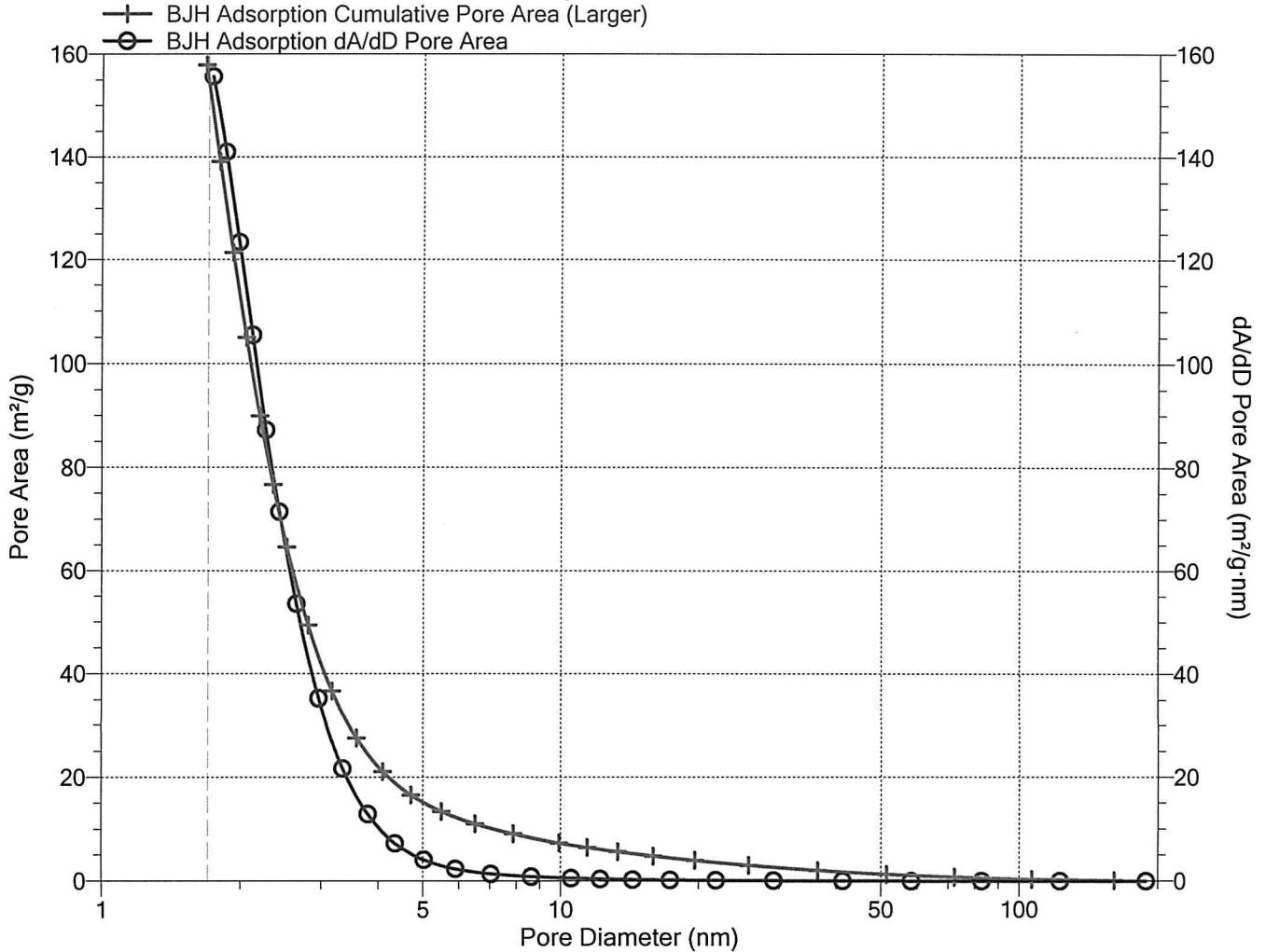
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Completed: 7/24/2019 3:19:44 AM
Report time: 7/24/2019 2:37:01 PM
Sample mass: 0.6583 g
Analysis free space: 53.7130 cm³
Low pressure dose: 0.5000 cm³/g STP
Automatic degas: No

Analysis adsorptive: N2
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

BJH Adsorption Cumulative Pore Area (Larger)

Halsey : Faas Correction





Particle Technology Labs

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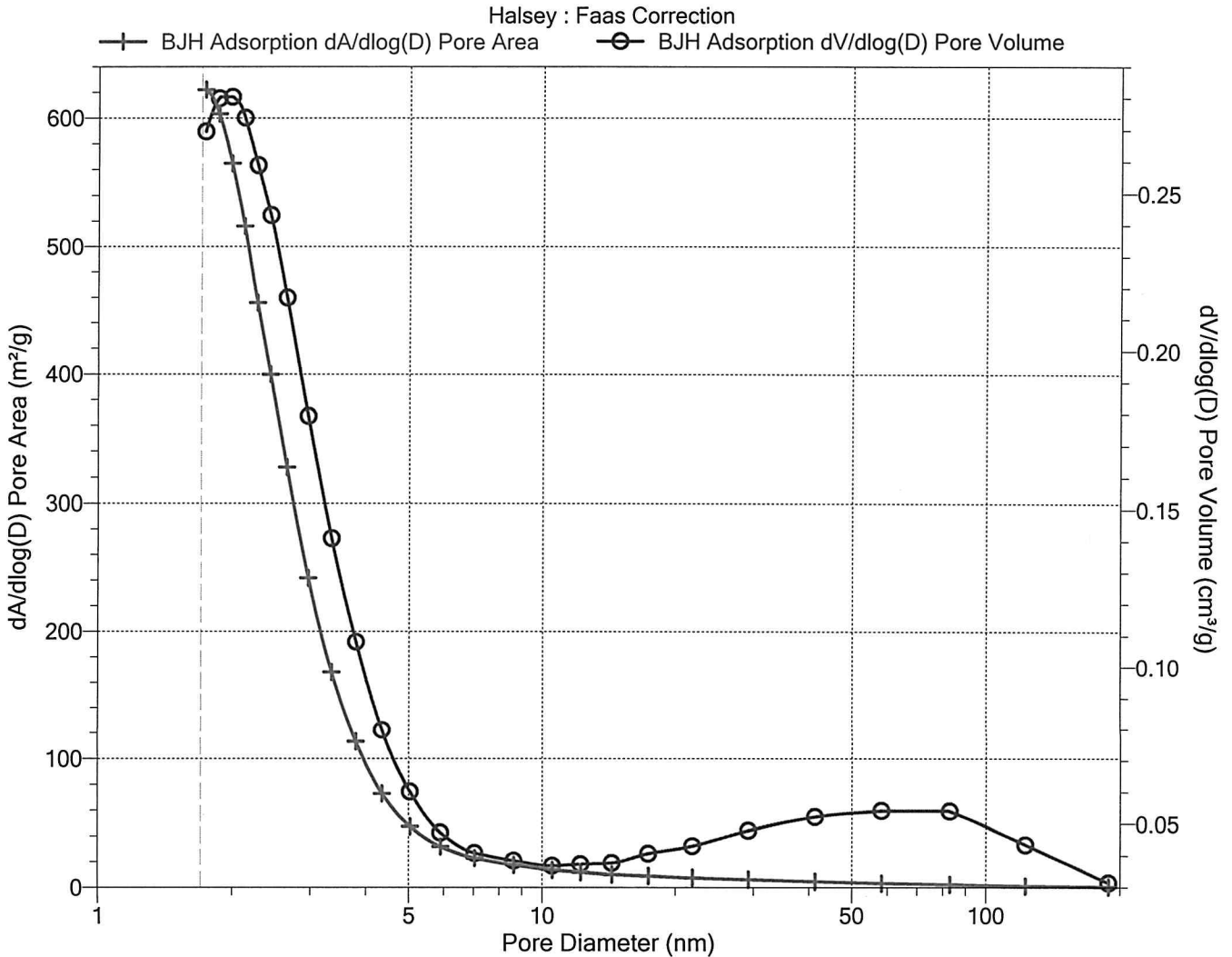
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Operator: JF
Submitter: Particle Technology Labs
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Started: 7/23/2019 11:27:52 AM
Completed: 7/24/2019 3:19:44 AM
Report time: 7/24/2019 2:37:01 PM
Sample mass: 0.6583 g
Analysis free space: 53.7130 cm³
Low pressure dose: 0.5000 cm³/g STP
Automatic degas: No

Analysis adsorptive: N2
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

BJH Adsorption dA/dlog(D) Pore Area





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Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

Started: 7/23/2019 11:27:52 AM
Completed: 7/24/2019 3:19:44 AM
Report time: 7/24/2019 2:37:01 PM
Sample mass: 0.6583 g
Analysis free space: 53.7130 cm³
Low pressure dose: 0.5000 cm³/g STP
Automatic degas: No
Analysis adsorptive: N2
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

BJH Desorption Pore Distribution Report

Faas Correction

Harkins and Jura

$$t = [13.99 / (0.034 - \log(p/p^{\circ}))] ^{0.5}$$

Diameter range: 1.7000 nm to 300.0000 nm

Adsorbate property factor: 0.95300 nm

Density conversion factor: 0.0015492

Fraction of pores open at both ends: 0.00

Pore Diameter Range (nm)	Average Diameter (nm)	Incremental Pore Volume (cm ³ /g)	Cumulative Pore Volume (cm ³ /g)	Incremental Pore Area (m ² /g)	Cumulative Pore Area (m ² /g)
264.7 - 120.5	144.7	0.004603	0.004603	0.127	0.127
120.5 - 82.2	94.2	0.005225	0.009828	0.222	0.349
82.2 - 57.4	65.4	0.006891	0.016718	0.421	0.771
57.4 - 40.2	45.7	0.008320	0.025038	0.728	1.499
40.2 - 27.2	31.2	0.010197	0.035236	1.308	2.807
27.2 - 21.2	23.4	0.006257	0.041493	1.067	3.875
21.2 - 17.1	18.7	0.005099	0.046591	1.089	4.964
17.1 - 14.3	15.4	0.004282	0.050873	1.110	6.074
14.3 - 12.2	13.1	0.003505	0.054378	1.074	7.147
12.2 - 10.7	11.3	0.002882	0.057260	1.017	8.164
10.7 - 8.5	9.3	0.005020	0.062280	2.156	10.320
8.5 - 7.1	7.7	0.003954	0.066233	2.063	12.383
7.1 - 6.1	6.5	0.003992	0.070225	2.461	14.844
6.1 - 5.2	5.6	0.004239	0.074464	3.043	17.887
5.2 - 4.6	4.9	0.004961	0.079425	4.084	21.971
4.6 - 4.1	4.3	0.007354	0.086779	6.844	28.815
4.1 - 3.6	3.8	0.021313	0.108092	22.482	51.297
3.6 - 3.2	3.4	0.014984	0.123077	17.736	69.032
3.2 - 2.9	3.0	0.013521	0.136597	17.787	86.819
2.9 - 2.7	2.8	0.007780	0.144378	11.055	97.874
2.7 - 2.6	2.7	0.008861	0.153238	13.333	111.207
2.6 - 2.4	2.5	0.009055	0.162293	14.422	125.629
2.4 - 2.3	2.4	0.009641	0.171935	16.243	141.872
2.3 - 2.2	2.2	0.010074	0.182009	17.969	159.841
2.2 - 2.1	2.1	0.010422	0.192431	19.712	179.553



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Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

Started: 7/23/2019 11:27:52 AM	Analysis adsorptive: N2
Completed: 7/24/2019 3:19:44 AM	Analysis bath temp.: 77.207 K
Report time: 7/24/2019 2:37:01 PM	Thermal correction: No
Sample mass: 0.6583 g	Ambient free space: 15.1981 cm ³ Measured
Analysis free space: 53.7130 cm ³	Equilibration interval: 20 to 30 s
Low pressure dose: 0.5000 cm ³ /g STP	Sample density: 1.000 g/cm ³
Automatic degas: No	

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

Pore Diameter Range (nm)	Average Diameter (nm)	Incremental Pore Volume (cm ³ /g)	Cumulative Pore Volume (cm ³ /g)	Incremental Pore Area (m ² /g)	Cumulative Pore Area (m ² /g)
2.1 - 1.9	2.0	0.009412	0.201842	18.862	198.415
1.9 - 1.8	1.9	0.010900	0.212742	23.338	221.754
1.8 - 1.7	1.7	0.008503	0.221245	19.559	241.313



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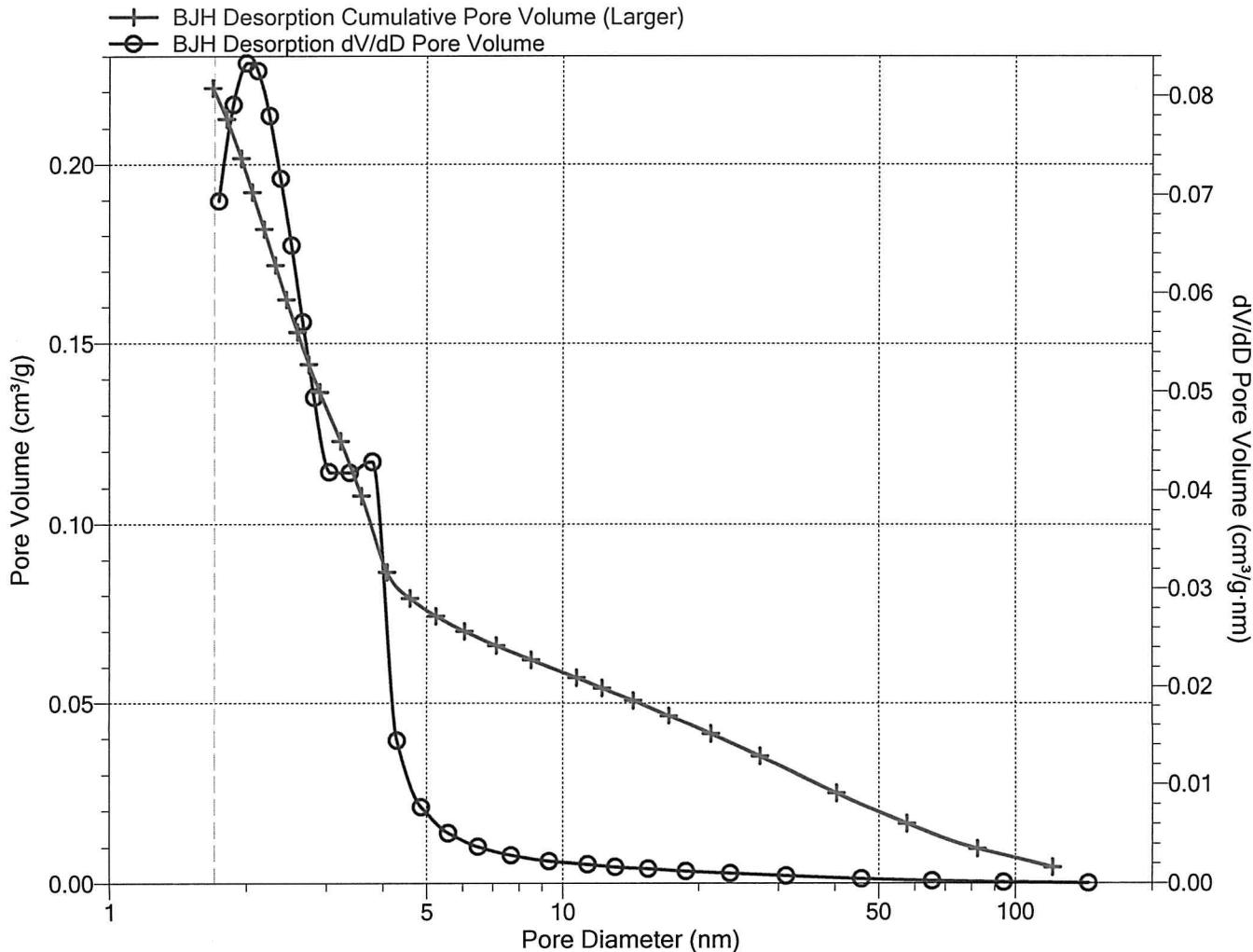
Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

Started: 7/23/2019 11:27:52 AM	Analysis adsorptive: N2
Completed: 7/24/2019 3:19:44 AM	Analysis bath temp.: 77.207 K
Report time: 7/24/2019 2:37:01 PM	Thermal correction: No
Sample mass: 0.6583 g	Ambient free space: 15.1981 cm ³ Measured
Analysis free space: 53.7130 cm ³	Equilibration interval: 20 to 30 s
Low pressure dose: 0.5000 cm ³ /g STP	Sample density: 1.000 g/cm ³
Automatic degas: No	

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

BJH Desorption Cumulative Pore Volume (Larger)

Harkins and Jura : Faas Correction





Particle Technology Labs

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Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

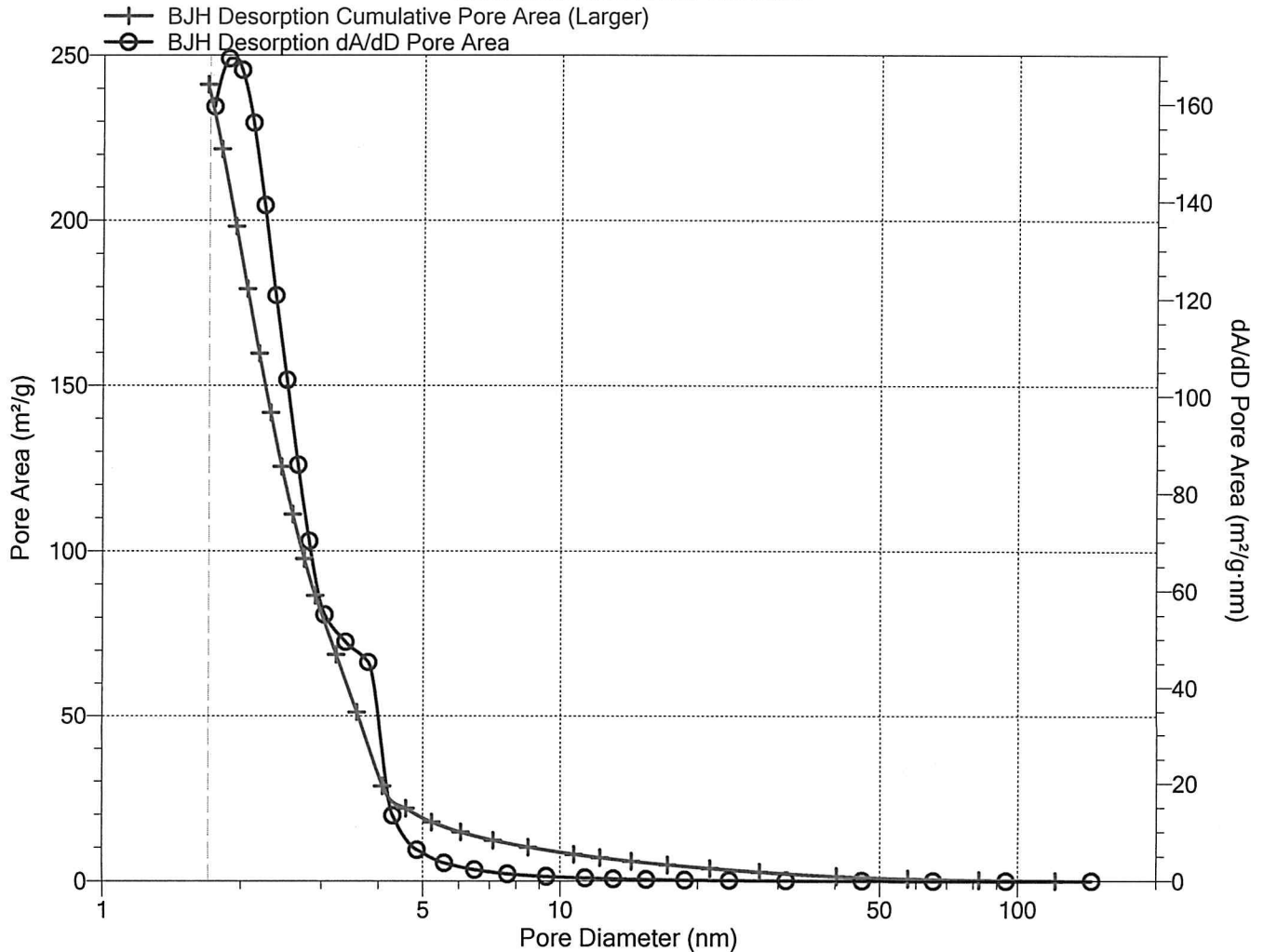
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Completed: 7/24/2019 3:19:44 AM
Report time: 7/24/2019 2:37:01 PM
Sample mass: 0.6583 g
Analysis free space: 53.7130 cm³
Low pressure dose: 0.5000 cm³/g STP
Automatic degas: No

Analysis adsorptive: N₂
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe₂O₃ 2019_07 Project #45391-21 PTL ID: 264412-21

BJH Desorption Cumulative Pore Area (Larger)

Harkins and Jura : Faas Correction





Particle Technology Labs

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Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

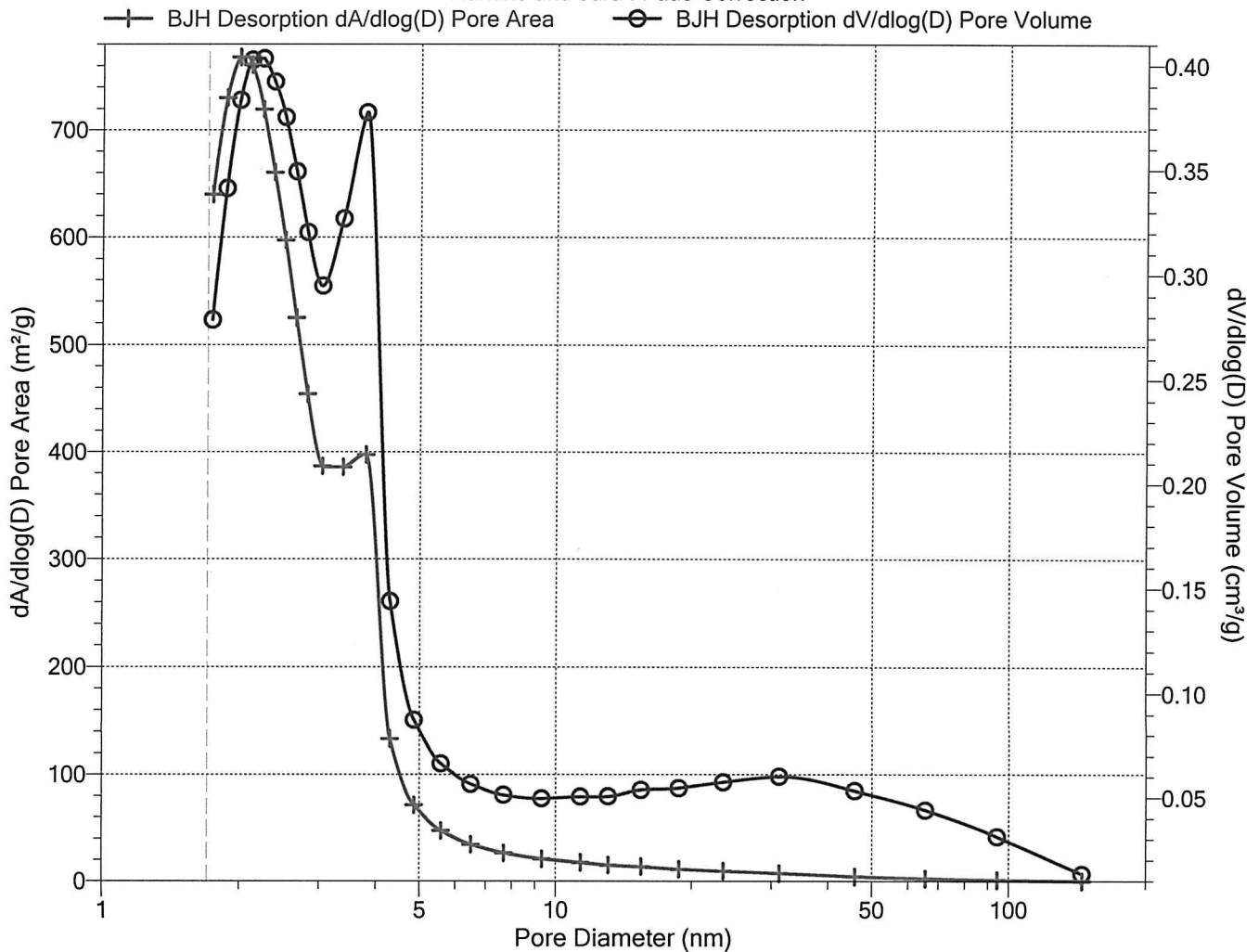
Started: 7/23/2019 11:27:52 AM
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Analysis free space: 53.7130 cm³
Low pressure dose: 0.5000 cm³/g STP
Automatic degas: No

Analysis adsorptive: N2
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

BJH Desorption dA/dlog(D) Pore Area

Harkins and Jura : Faas Correction





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Sample: 4539121A
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Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

Porosity Distribution by Invalid
Model: N2 - Cylindrical Pores - Oxide Surface
Method: Non-negative Regularization: 0.10000
Standard Deviation of Fit: 2.47816 cm³/g STP

Volume in Pores < 0.844 nm : 0.00000 cm³/g
Total Volume in Pores <= 38.734 nm : 0.17822 cm³/g
Area in Pores > 38.734 nm : 4.777 m²/g
Total Area in Pores >= 0.844 nm : 186.963 m²/g

Pore Table				
Pore Width (nm)	Cumulative Pore Volume (cm ³ /g)	Incremental Pore Volume (cm ³ /g)	Cumulative Pore Area (m ² /g)	Incremental Pore Area (m ² /g)
0.844	0.00000	0.00000	0.000	0.000
0.879	0.00000	0.00000	0.000	0.000
0.915	0.00020	0.00020	0.864	0.864
0.951	0.00080	0.00060	3.388	2.524
0.987	0.00178	0.00098	7.379	3.991
1.022	0.00293	0.00115	11.860	4.482
1.058	0.00396	0.00103	15.769	3.909
1.094	0.00471	0.00075	18.498	2.729
1.130	0.00511	0.00041	19.934	1.436
1.165	0.00524	0.00012	20.353	0.419
1.201	0.00524	0.00000	20.353	0.000
1.237	0.00524	0.00000	20.353	0.000
1.273	0.00524	0.00000	20.353	0.000
1.308	0.00524	0.00000	20.353	0.000
1.344	0.00533	0.00010	20.640	0.287
1.380	0.00576	0.00043	21.892	1.252
1.416	0.00617	0.00041	23.046	1.154
1.451	0.00620	0.00003	23.137	0.091
1.487	0.00620	0.00000	23.137	0.000
1.523	0.00620	0.00000	23.137	0.000
1.559	0.00620	0.00000	23.137	0.000
1.594	0.00620	0.00000	23.137	0.000
1.630	0.00620	0.00000	23.137	0.000
1.666	0.00620	0.00000	23.137	0.000



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Sample: 4539121A
Operator: JF
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File: C:\3Flex\data\45391-21\4539121A.SMP

Started: 7/23/2019 11:27:52 AM
Completed: 7/24/2019 3:19:44 AM
Report time: 7/24/2019 2:37:01 PM
Sample mass: 0.6583 g
Analysis free space: 53.7130 cm³
Low pressure dose: 0.5000 cm³/g STP
Automatic degas: No
Analysis adsorptive: N2
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

Pore Width (nm)	Cumulative Pore Volume (cm ³ /g)	Pore Table		
		Incremental Pore Volume (cm ³ /g)	Cumulative Pore Area (m ² /g)	Incremental Pore Area (m ² /g)
1.702	0.00634	0.00013	23.444	0.307
1.737	0.00634	0.00000	23.444	0.000
1.773	0.00634	0.00000	23.444	0.000
1.809	0.00634	0.00000	23.444	0.000
1.844	0.00634	0.00000	23.444	0.000
1.880	0.00634	0.00000	23.444	0.000
1.916	0.00634	0.00000	23.444	0.000
1.952	0.00634	0.00000	23.444	0.000
1.987	0.00634	0.00000	23.444	0.000
2.023	0.00634	0.00000	23.444	0.000
2.059	0.00634	0.00000	23.444	0.000
2.095	0.00634	0.00000	23.444	0.000
2.130	0.00634	0.00000	23.444	0.000
2.166	0.00634	0.00000	23.444	0.000
2.238	0.00634	0.00000	23.444	0.000
2.309	0.00634	0.00000	23.444	0.000
2.381	0.00634	0.00000	23.444	0.000
2.452	0.00649	0.00016	23.701	0.258
2.524	0.00720	0.00070	24.819	1.117
2.595	0.00880	0.00160	27.291	2.472
2.667	0.01154	0.00274	31.393	4.103
2.738	0.01549	0.00396	37.173	5.780
2.810	0.02055	0.00506	44.376	7.203
2.881	0.02647	0.00592	52.591	8.215
2.953	0.03295	0.00648	61.371	8.780
3.024	0.03963	0.00668	70.206	8.835
3.096	0.04617	0.00654	78.652	8.447
3.167	0.05233	0.00616	86.430	7.778
3.239	0.05801	0.00569	93.456	7.026
3.310	0.06321	0.00519	99.733	6.277
3.382	0.06795	0.00475	105.346	5.613
3.453	0.07238	0.00443	110.474	5.127
3.525	0.07660	0.00422	115.266	4.793
3.596	0.08070	0.00409	119.820	4.554



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Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

Started: 7/23/2019 11:27:52 AM
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Report time: 7/24/2019 2:37:01 PM
Sample mass: 0.6583 g
Analysis free space: 53.7130 cm³
Low pressure dose: 0.5000 cm³/g STP
Automatic degas: No
Analysis adsorptive: N2
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

Pore Table				
Pore Width (nm)	Cumulative Pore Volume (cm ³ /g)	Incremental Pore Volume (cm ³ /g)	Cumulative Pore Area (m ² /g)	Incremental Pore Area (m ² /g)
3.668	0.08465	0.00395	124.131	4.310
3.739	0.08838	0.00374	128.127	3.996
3.811	0.09188	0.00349	131.791	3.664
3.882	0.09510	0.00323	135.116	3.325
3.954	0.09809	0.00299	138.140	3.024
4.025	0.10088	0.00278	140.907	2.768
4.096	0.10351	0.00264	143.481	2.574
4.168	0.10604	0.00252	145.903	2.422
4.239	0.10848	0.00244	148.207	2.304
4.311	0.11083	0.00236	150.394	2.186
4.382	0.11309	0.00226	152.455	2.062
4.454	0.11521	0.00212	154.357	1.902
4.525	0.11714	0.00193	156.060	1.703
4.597	0.11881	0.00168	157.519	1.459
4.668	0.12023	0.00141	158.729	1.211
4.740	0.12143	0.00120	159.745	1.016
4.811	0.12261	0.00118	160.727	0.982
4.883	0.12398	0.00137	161.850	1.123
4.954	0.12571	0.00173	163.243	1.393
5.026	0.12787	0.00216	164.961	1.718
5.205	0.13041	0.00255	166.920	1.960
5.491	0.13308	0.00267	168.864	1.944
5.777	0.13556	0.00248	170.581	1.717
6.098	0.13774	0.00218	172.009	1.428
6.420	0.13957	0.00183	173.152	1.143
6.742	0.14108	0.00151	174.045	0.894
7.099	0.14230	0.00122	174.734	0.689
7.457	0.14331	0.00101	175.276	0.542
7.850	0.14421	0.00090	175.733	0.457
8.279	0.14501	0.00080	176.120	0.386
8.708	0.14571	0.00070	176.441	0.322
9.137	0.14638	0.00067	176.735	0.294
9.637	0.14708	0.00070	177.026	0.291
10.138	0.14774	0.00066	177.284	0.259



Particle Technology Labs

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Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

Started: 7/23/2019 11:27:52 AM
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Analysis adsorptive: N2
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

Pore Table				
Pore Width (nm)	Cumulative Pore Volume (cm ³ /g)	Incremental Pore Volume (cm ³ /g)	Cumulative Pore Area (m ² /g)	Incremental Pore Area (m ² /g)
10.638	0.14830	0.00057	177.498	0.214
11.210	0.14889	0.00058	177.707	0.209
11.782	0.14958	0.00069	177.941	0.234
12.390	0.15027	0.00069	178.163	0.222
13.033	0.15083	0.00056	178.335	0.172
13.676	0.15130	0.00048	178.474	0.139
14.391	0.15178	0.00048	178.607	0.133
15.106	0.15235	0.00057	178.758	0.151
15.893	0.15308	0.00073	178.942	0.184
16.715	0.15381	0.00073	179.117	0.175
17.573	0.15439	0.00058	179.248	0.131
18.466	0.15490	0.00051	179.359	0.111
19.396	0.15542	0.00051	179.465	0.106
20.397	0.15593	0.00052	179.567	0.101
21.433	0.15645	0.00052	179.663	0.097
22.506	0.15700	0.00055	179.761	0.098
23.650	0.15764	0.00064	179.869	0.108
24.829	0.15849	0.00085	180.006	0.137
26.116	0.15934	0.00085	180.136	0.130
27.439	0.16000	0.00066	180.232	0.097
28.797	0.16063	0.00063	180.320	0.088
30.263	0.16126	0.00063	180.403	0.083
31.800	0.16193	0.00067	180.488	0.084
33.408	0.16260	0.00067	180.568	0.081
35.088	0.16284	0.00023	180.595	0.027
36.876	0.16360	0.00076	180.677	0.082
38.734	0.17822	0.01462	182.187	1.510



Particle Technology Labs

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3Flex 4.05

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Serial # 862 Unit 1 Port 1

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Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

Started: 7/23/2019 11:27:52 AM
Completed: 7/24/2019 3:19:44 AM
Report time: 7/24/2019 2:37:01 PM
Sample mass: 0.6583 g
Analysis free space: 53.7130 cm³
Low pressure dose: 0.5000 cm³/g STP
Automatic degas: No
Analysis adsorptive: N2
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

Porosity Distribution by Invalid
Model: N2 - Cylindrical Pores - Oxide Surface
Method: Non-negative Regularization: 0.10000
Standard Deviation of Fit: 2.47816 cm³/g STP

Isotherm Table				
Relative Pressure (p/p ^o)	Experimental Quantity Adsorbed (cm ³ /g STP)	Fitted Quantity Adsorbed (cm ³ /g STP)	Absolute Residual (cm ³ /g STP)	Relative Residual
0.000003162	0.6283	2.4243	-1.7960	-2.858747
0.000003981	0.9370	2.9662	-2.0291	-2.165487
0.000005012	1.3240	3.5600	-2.2360	-1.688813
0.000006310	1.8077	4.1370	-2.3293	-1.288530
0.000007943	2.4099	4.6916	-2.2817	-0.946813
0.000010000	3.1548	5.3555	-2.2007	-0.697566
0.000012589	4.0666	5.9336	-1.8671	-0.459129
0.000015849	5.1631	6.6925	-1.5294	-0.296224
0.000019953	6.4421	7.3369	-0.8948	-0.138905
0.000025119	7.8511	8.1429	-0.2918	-0.037167
0.000031623	9.2263	8.8395	0.3868	0.041921
0.000039811	10.1656	9.6543	0.5113	0.050296
0.000050119	10.7222	10.4015	0.3207	0.029911
0.000063096	11.4022	11.2096	0.1926	0.016892
0.000079433	12.2250	11.9962	0.2288	0.018717
0.000100000	13.2070	12.8014	0.4056	0.030714
0.000125892	14.3563	13.6117	0.7445	0.051860
0.000158490	15.6613	14.4395	1.2218	0.078015
0.000199526	17.0722	15.2886	1.7836	0.104475
0.000251188	18.4656	16.1604	2.3053	0.124841
0.000316228	19.5837	17.0631	2.5205	0.128706
0.000398107	20.0459	18.0099	2.0360	0.101565
0.000501187	20.3996	18.9871	1.4126	0.069244
0.000630958	20.8610	19.9643	0.8967	0.042984
0.000794328	21.4625	20.9547	0.5078	0.023661
0.001000000	22.2438	21.9600	0.2838	0.012757
0.001258925	23.2472	22.9863	0.2610	0.011225
0.001584895	24.5061	24.0312	0.4749	0.019379



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Serial # 862 Unit 1 Port 1

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Sample: 4539121A
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File: C:\3Flex\data\45391-21\4539121A.SMP

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Analysis adsorptive: N2
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

Isotherm Table

Relative Pressure (p/p ^o)	Experimental Quantity Adsorbed (cm ³ /g STP)	Fitted Quantity Adsorbed (cm ³ /g STP)	Absolute Residual (cm ³ /g STP)	Relative Residual
0.001995263	26.0123	25.0987	0.9136	0.035123
0.002511882	27.6407	26.1875	1.4531	0.052573
0.003162276	28.9807	27.2999	1.6808	0.057996
0.003981066	29.4874	28.4366	1.0508	0.035637
0.005011868	30.0074	29.5998	0.4076	0.013585
0.006309579	30.6853	30.7969	-0.1116	-0.003637
0.007943276	31.5593	32.0331	-0.4738	-0.015012
0.010000000	32.6605	33.3144	-0.6540	-0.020023
0.012355640	33.8695	34.5236	-0.6541	-0.019312
0.015186320	35.1586	35.7404	-0.5818	-0.016549
0.018485530	36.2905	36.9330	-0.6425	-0.017704
0.022294740	37.2006	38.1132	-0.9126	-0.024532
0.026653420	38.0817	39.2739	-1.1923	-0.031308
0.031598160	38.9636	40.4534	-1.4898	-0.038236
0.037162240	39.9502	41.6287	-1.6784	-0.042014
0.043374470	40.9960	42.8150	-1.8190	-0.044371
0.050259210	42.0262	44.0048	-1.9787	-0.047082
0.057835260	43.1034	45.1738	-2.0704	-0.048033
0.066115920	44.2690	46.3219	-2.0530	-0.046375
0.075109080	45.5096	47.4434	-1.9339	-0.042494
0.084815920	46.8179	48.5331	-1.7152	-0.036636
0.095232370	48.2178	49.5927	-1.3749	-0.028515
0.106348200	49.7171	50.6526	-0.9355	-0.018816
0.118147500	51.3165	51.7516	-0.4351	-0.008478
0.130609100	53.0261	52.9473	0.0788	0.001486
0.143706600	54.8581	54.2865	0.5715	0.010418
0.157410500	56.7995	55.7641	1.0355	0.018230
0.171685500	58.8381	57.8340	1.0040	0.017064
0.186492100	60.9726	59.7216	1.2510	0.020517
0.201792100	63.1647	62.6252	0.5395	0.008542
0.217539500	65.3858	64.7385	0.6472	0.009899
0.233689500	67.6253	66.8029	0.8225	0.012162
0.250196100	69.8594	69.6890	0.1704	0.002439



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Serial # 862 Unit 1 Port 1

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Sample: 4539121A
Operator: JF
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File: C:\3Flex\data\45391-21\4539121A.SMP

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Analysis adsorptive: N2
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

Isotherm Table

Relative Pressure (p/p°)	Experimental Quantity Adsorbed (cm ³ /g STP)	Fitted Quantity Adsorbed (cm ³ /g STP)	Absolute Residual (cm ³ /g STP)	Relative Residual
0.267011800	72.0608	71.5184	0.5425	0.007528
0.284089500	74.2261	73.9935	0.2326	0.003133
0.301380300	76.3266	76.3484	-0.0219	-0.000286
0.318838200	78.3433	77.8908	0.4525	0.005776
0.336417100	80.2896	80.0319	0.2577	0.003210
0.354071100	82.1516	81.9836	0.1680	0.002045
0.371757900	83.9218	83.7734	0.1484	0.001768
0.389435500	85.5917	85.4638	0.1278	0.001494
0.407065800	87.1680	87.0738	0.0942	0.001080
0.424610500	88.6394	88.5470	0.0925	0.001043
0.442034200	90.0051	89.7894	0.2158	0.002397
0.459305300	91.2722	91.1930	0.0791	0.000867
0.476393400	92.4540	92.6289	-0.1748	-0.001891
0.493271100	93.5461	93.7249	-0.1788	-0.001911
0.509911800	94.5542	94.1368	0.4174	0.004414
0.526293400	95.4978	95.2544	0.2434	0.002549
0.542394700	96.3638	96.3284	0.0354	0.000367
0.558200000	97.1519	97.3242	-0.1723	-0.001774
0.573690800	97.8921	97.6645	0.2275	0.002324
0.588853900	98.5782	98.5445	0.0338	0.000342
0.603677600	99.2055	99.3255	-0.1200	-0.001209
0.618153900	99.8024	99.6246	0.1778	0.001781
0.632272400	100.3697	100.3037	0.0660	0.000658
0.646028900	100.8997	100.9134	-0.0136	-0.000135
0.659417100	101.3955	101.4847	-0.0893	-0.000880
0.672435500	101.8732	101.7434	0.1297	0.001274
0.685081600	102.3368	102.2727	0.0641	0.000627
0.697355300	102.7895	102.7667	0.0228	0.000222
0.709256600	103.2323	103.2494	-0.0171	-0.000166
0.720789500	103.6639	103.7438	-0.0799	-0.000771
0.731953900	104.0845	103.9703	0.1143	0.001098
0.742756600	104.4943	104.4432	0.0511	0.000489
0.753200000	104.8971	104.8828	0.0143	0.000137



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Serial # 862 Unit 1 Port 1

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Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

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Automatic degas: No
Analysis adsorptive: N2
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

Isotherm Table

Relative Pressure (p/p°)	Experimental Quantity Adsorbed (cm ³ /g STP)	Fitted Quantity Adsorbed (cm ³ /g STP)	Absolute Residual (cm ³ /g STP)	Relative Residual
0.763289500	105.3086	105.3297	-0.0211	-0.000200
0.773030300	105.7243	105.8192	-0.0949	-0.000897
0.782430300	106.1381	106.0236	0.1145	0.001079
0.791496100	106.5451	106.5077	0.0374	0.000351
0.800232900	106.9425	106.9395	0.0030	0.000028
0.808648700	107.3446	107.3357	0.0089	0.000083
0.816752600	107.7509	107.7328	0.0181	0.000168
0.824552600	108.1560	108.1697	-0.0137	-0.000127
0.832053900	108.5674	108.6803	-0.1129	-0.001040
0.839267100	108.9851	108.8599	0.1252	0.001149
0.846200000	109.4000	109.3724	0.0276	0.000253
0.852860500	109.8115	109.8155	-0.0039	-0.000036
0.859257900	110.2350	110.2315	0.0035	0.000032
0.865398700	110.6634	110.6567	0.0067	0.000061
0.871292100	111.0895	111.0829	0.0066	0.000059
0.876947400	111.5190	111.5153	0.0037	0.000033
0.882369700	111.9757	111.9631	0.0125	0.000112
0.887569700	112.4459	112.4558	-0.0099	-0.000088
0.892553900	112.9161	113.0550	-0.1389	-0.001230
0.897328900	113.3754	113.2294	0.1460	0.001288
0.901905300	113.8434	113.8289	0.0146	0.000128
0.906286800	114.3343	114.3396	-0.0053	-0.000047
0.910484200	114.8370	114.8311	0.0059	0.000052
0.914501300	115.3419	115.3371	0.0048	0.000042
0.918347400	115.8419	115.8577	-0.0158	-0.000136
0.922026300	116.3308	116.3919	-0.0612	-0.000526
0.925547400	116.8381	116.7020	0.1361	0.001165
0.928915800	117.3798	117.2833	0.0964	0.000822
0.932136800	117.9427	125.2862	-7.3434	-0.062263
0.935218400	118.5169	125.4489	-6.9320	-0.058489
0.938163200	119.0932	125.6043	-6.5111	-0.054672
0.940978900	119.6652	125.7677	-6.1025	-0.050997
0.943669700	120.2271	125.9504	-5.7233	-0.047604



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Serial # 862 Unit 1 Port 1

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Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

Started: 7/23/2019 11:27:52 AM
Completed: 7/24/2019 3:19:44 AM
Report time: 7/24/2019 2:37:01 PM
Sample mass: 0.6583 g
Analysis free space: 53.7130 cm³
Low pressure dose: 0.5000 cm³/g STP
Automatic degas: No
Analysis adsorptive: N2
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

Isotherm Table				
Relative Pressure (p/p ^o)	Experimental Quantity Adsorbed (cm ³ /g STP)	Fitted Quantity Adsorbed (cm ³ /g STP)	Absolute Residual (cm ³ /g STP)	Relative Residual
0.946242100	120.7830	126.1249	-5.3419	-0.044227
0.948700000	121.3724	126.2916	-4.9192	-0.040530
0.951048700	121.9893	126.4719	-4.4825	-0.036745
0.953292100	122.6213	126.6687	-4.0474	-0.033008
0.955435500	123.2588	126.8568	-3.5980	-0.029191
0.957482900	123.8938	127.0364	-3.1426	-0.025365
0.959438200	124.5199	127.2079	-2.6880	-0.021587
0.961305300	125.1321	127.4130	-2.2809	-0.018228
0.963088200	125.7466	127.6259	-1.8792	-0.014945
0.964789500	126.3782	127.8289	-1.4507	-0.011479
0.966414500	127.0240	128.0229	-0.9988	-0.007863
0.967965800	127.6806	128.2080	-0.5274	-0.004130
0.969447400	128.3453	128.3848	-0.0395	-0.000307
0.970860500	129.0144	128.6236	0.3908	0.003029
0.972209200	129.6858	128.8945	0.7913	0.006102
0.973496100	130.3591	129.1530	1.2062	0.009253
0.974725000	131.0379	129.3998	1.6381	0.012501
0.975897400	131.7169	129.6352	2.0817	0.015804
0.977015800	132.3919	129.8598	2.5321	0.019126
0.978082900	133.0597	130.0741	2.9855	0.022438
0.979101300	133.7175	130.2786	3.4388	0.025717
0.980072400	134.3625	130.4732	3.8893	0.028947
0.980998700	134.9932	130.6539	4.3393	0.032145
0.981882900	135.6073	130.8265	4.7809	0.035255
0.982726300	136.1951	130.9910	5.2041	0.038211
0.983530300	136.7604	131.1479	5.6125	0.041039
0.984297400	137.3091	131.2976	6.0115	0.043781
0.985028900	137.8451	131.8789	5.9663	0.043283
0.985727600	138.3726	132.4340	5.9386	0.042917
0.986392100	138.8915	132.9621	5.9294	0.042691
0.987027600	139.4062	133.4670	5.9392	0.042603
0.987632900	139.9157	133.9480	5.9677	0.042652
0.988209200	140.4161	134.8789	5.5372	0.039434



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Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

Started: 7/23/2019 11:27:52 AM	Analysis adsorptive: N2
Completed: 7/24/2019 3:19:44 AM	Analysis bath temp.: 77.207 K
Report time: 7/24/2019 2:37:01 PM	Thermal correction: No
Sample mass: 0.6583 g	Ambient free space: 15.1981 cm ³ Measured
Analysis free space: 53.7130 cm ³	Equilibration interval: 20 to 30 s
Low pressure dose: 0.5000 cm ³ /g STP	Sample density: 1.000 g/cm ³
Automatic degas: No	

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

Isotherm Table				
Relative Pressure (p/p ^o)	Experimental Quantity Adsorbed (cm ³ /g STP)	Fitted Quantity Adsorbed (cm ³ /g STP)	Absolute Residual (cm ³ /g STP)	Relative Residual
0.988760500	140.8960	136.5634	4.3326	0.030750
0.989285500	141.3529	138.1675	3.1854	0.022535
0.989785500	141.7881	139.6952	2.0929	0.014761
0.990263200	142.2039	141.9860	0.2179	0.001532
0.990718400	142.6001	144.8144	-2.2143	-0.015528
0.991151300	142.9769	147.5043	-4.5274	-0.031665
0.991565800	143.3376	150.0798	-6.7422	-0.047037
0.991959200	143.6800	152.5242	-8.8442	-0.061555



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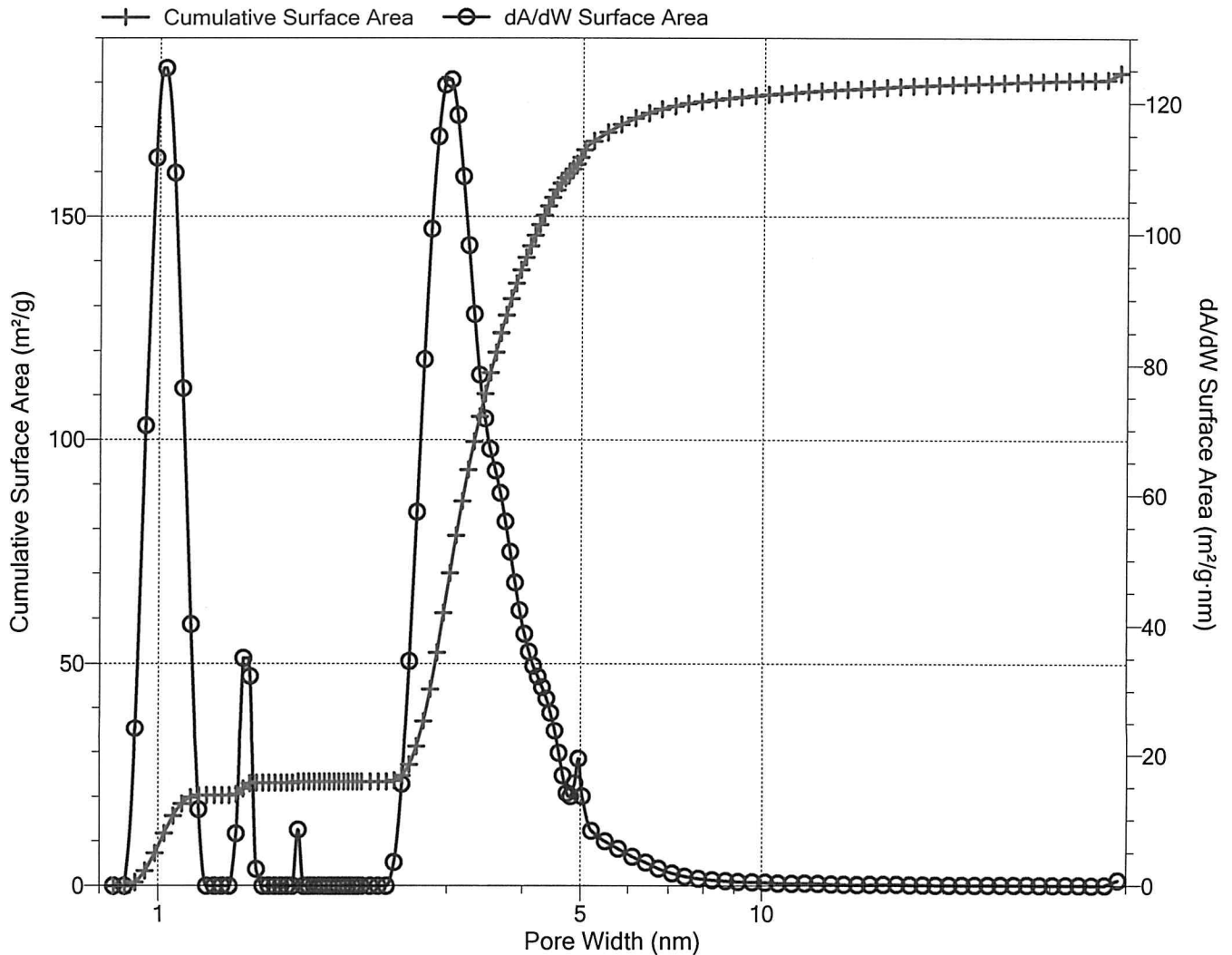
Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

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Automatic degas: No

Analysis adsorptive: N₂
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe₂O₃ 2019_07 Project #45391-21 PTL ID: 264412-21

Cumulative Surface Area vs. Pore Width





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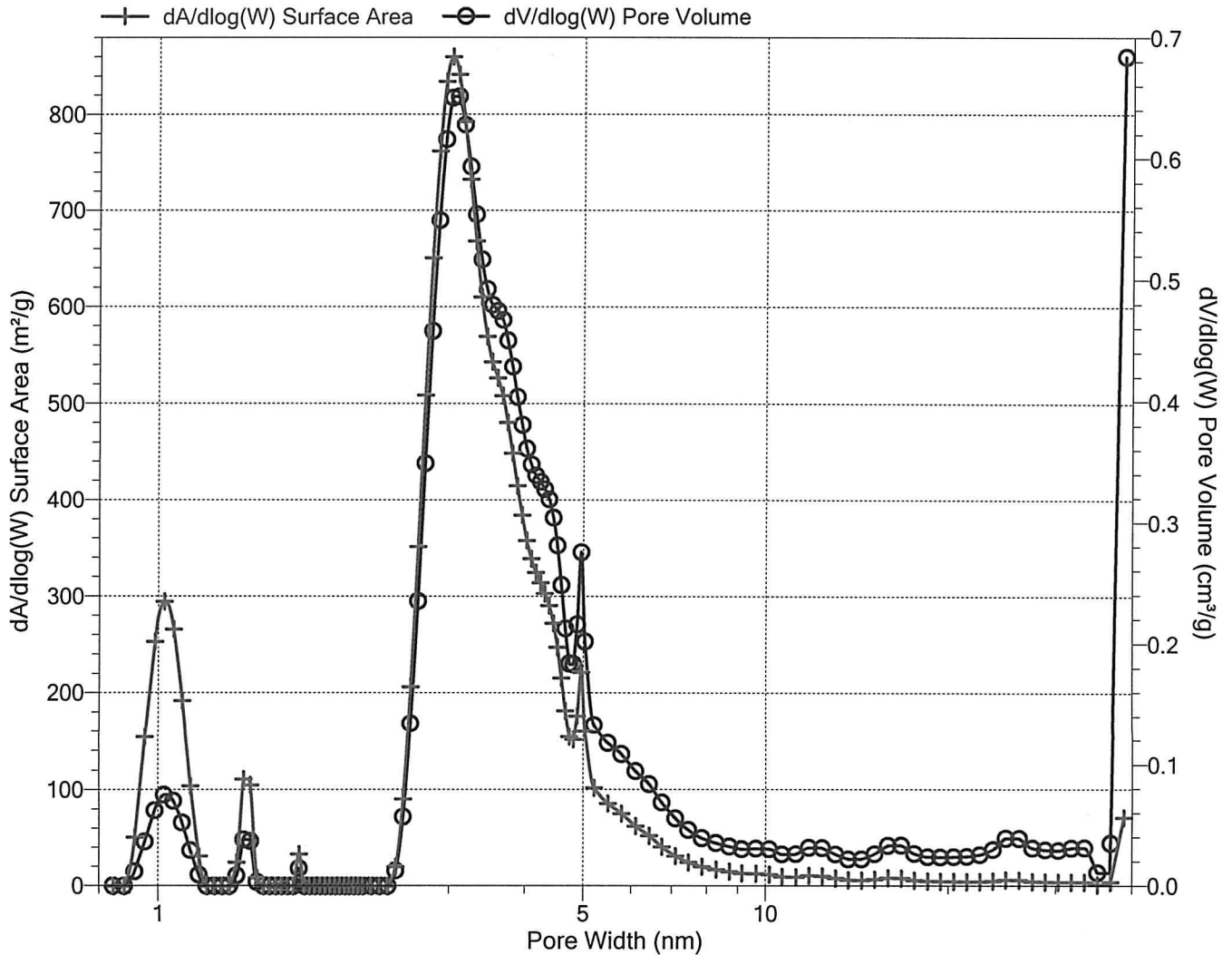
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Ambient free space: 15.1981 cm³ Measured
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Comments: Fe₂O₃ 2019_07 Project #45391-21 PTL ID: 264412-21

dA/dlog(W) Surface Area vs. Pore Width





Particle Technology Labs

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3Flex 4.05

3Flex Version 4.05
Serial # 862 Unit 1 Port 1

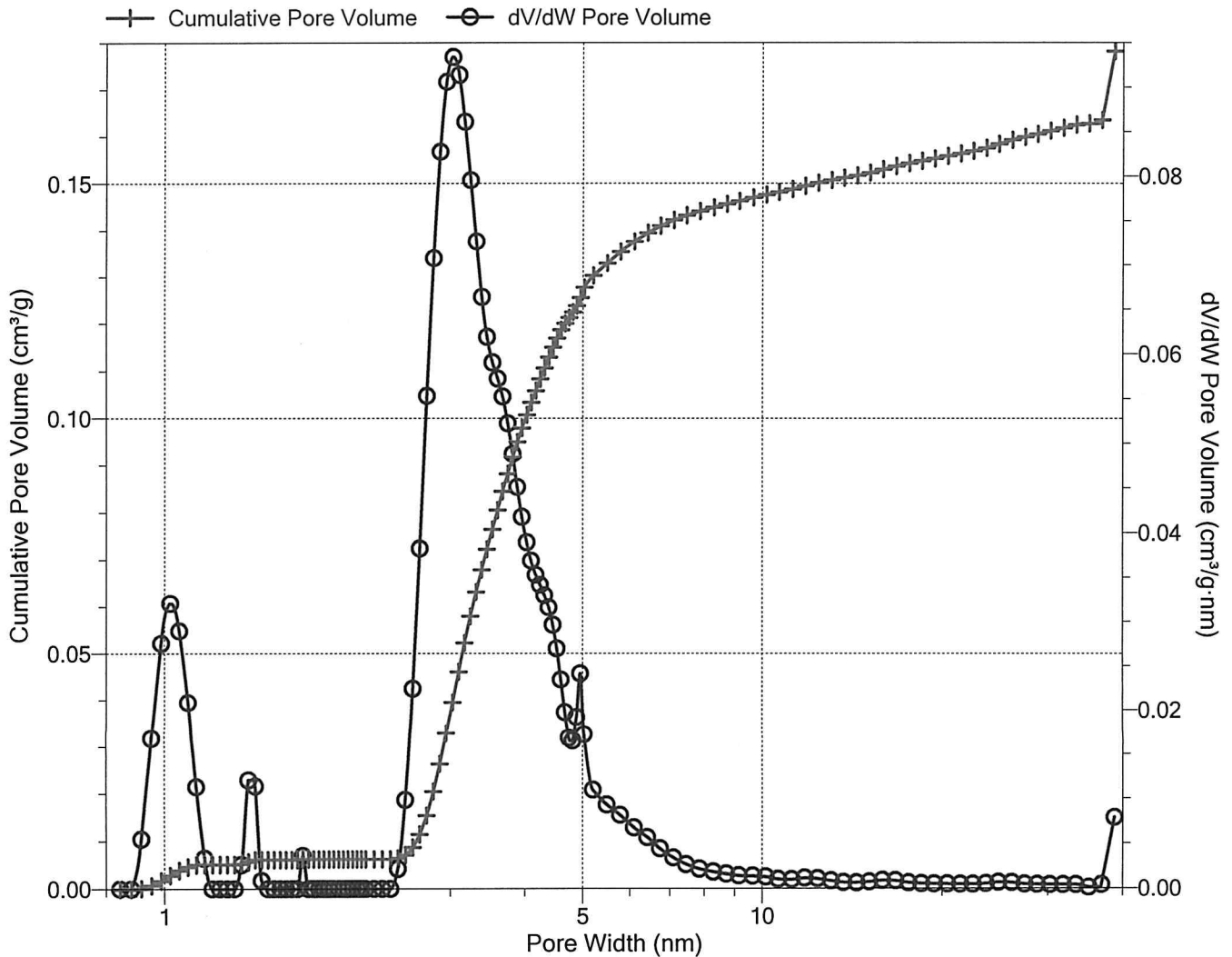
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Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

Started: 7/23/2019 11:27:52 AM
Completed: 7/24/2019 3:19:44 AM
Report time: 7/24/2019 2:37:01 PM
Sample mass: 0.6583 g
Analysis free space: 53.7130 cm³
Low pressure dose: 0.5000 cm³/g STP
Automatic degas: No
Analysis adsorptive: N₂
Analysis bath temp.: 77.207 K
Thermal correction: No
Ambient free space: 15.1981 cm³ Measured
Equilibration interval: 20 to 30 s
Sample density: 1.000 g/cm³

Comments: Fe₂O₃ 2019_07 Project #45391-21 PTL ID: 264412-21

Cumulative Pore Volume vs. Pore Width





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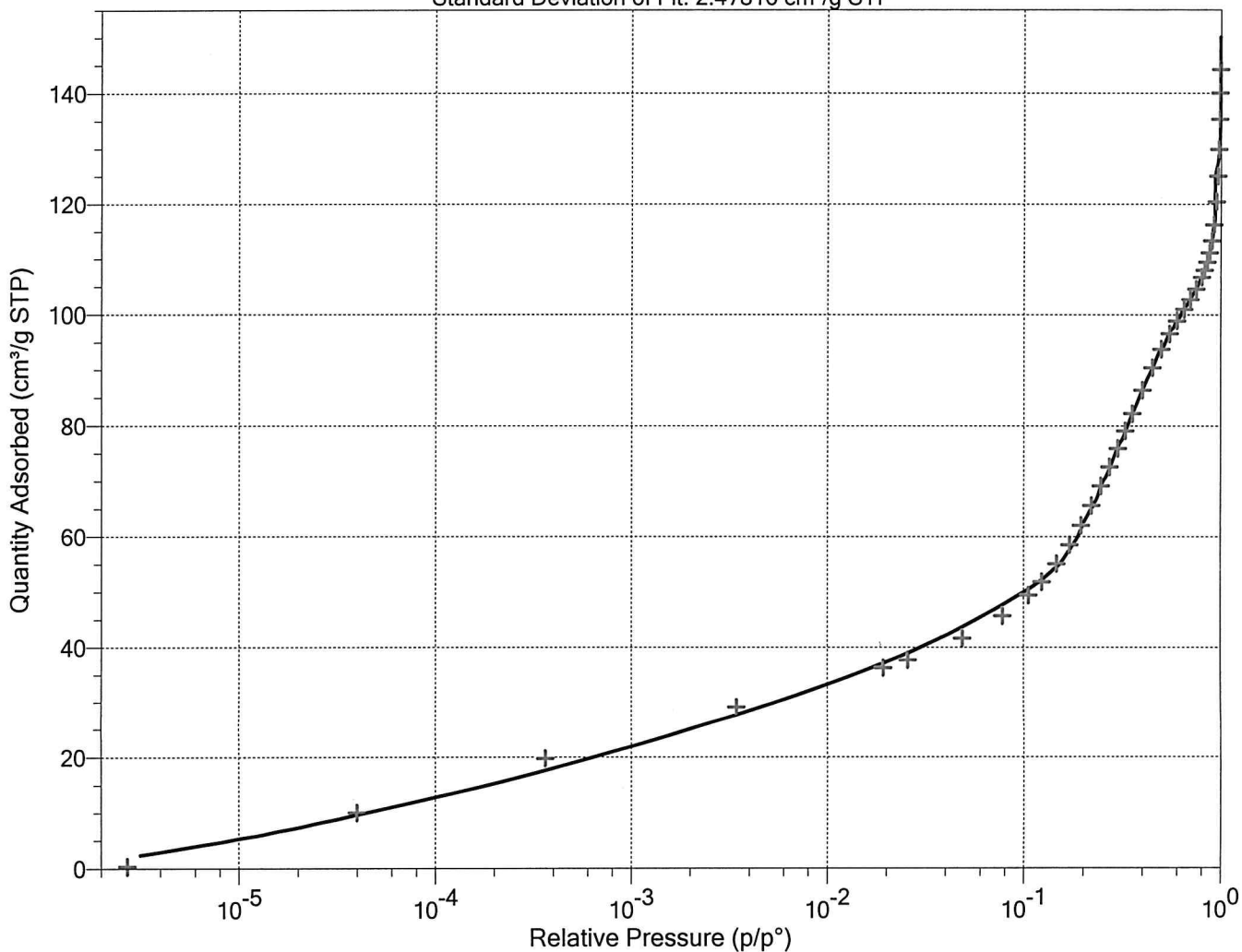
Sample: 4539121A
Operator: JF
Submitter: Particle Technology Labs
File: C:\3Flex\data\45391-21\4539121A.SMP

Started: 7/23/2019 11:27:52 AM	Analysis adsorptive: N2
Completed: 7/24/2019 3:19:44 AM	Analysis bath temp.: 77.207 K
Report time: 7/24/2019 2:37:01 PM	Thermal correction: No
Sample mass: 0.6583 g	Ambient free space: 15.1981 cm ³ Measured
Analysis free space: 53.7130 cm ³	Equilibration interval: 20 to 30 s
Low pressure dose: 0.5000 cm ³ /g STP	Sample density: 1.000 g/cm ³
Automatic degas: No	

Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

Goodness of Fit

Standard Deviation of Fit: 2.47816 cm³/g STP





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3Flex 4.05

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Serial # 862 Unit 1 Port 1

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Comments: Fe2O3 2019_07 Project #45391-21 PTL ID: 264412-21

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