

Sample: FULL- N2@77K- ADS/DES

Operator:

Submitter:

File: D:\OneDrive - Zachodniopomorski Uniwersytet Technologiczny w  
Szczecinie\Doktorat\B...\BicSi\_FULL.SMP

Started:	18.11.2022 14:39:39	Analysis adsorptive:	N2
Completed:	21.11.2022 18:42:54	Analysis bath temp.:	77,300 K
Report time:	22.11.2022 14:25:20	Thermal correction:	Yes
Sample mass:	0,8902 g	Ambient free space:	28,0000 cm <sup>3</sup> Entered
Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

## Summary Report

## Surface Area

BET Surface Area: 81,3367 m<sup>2</sup>/gt-Plot Micropore Area: 8,8869 m<sup>2</sup>/gt-Plot external surface area: 72,4497 m<sup>2</sup>/g

## DFT Pore Size

Volume in Pores	<	5,58 Å	0,00105 cm <sup>3</sup> /g
Total Volume in Pores	<=	175,73 Å	0,05473 cm <sup>3</sup> /g
Area in Pores	>	175,73 Å	10,151 m <sup>2</sup> /g
Total Area in Pores	>=	5,58 Å	71,382 m <sup>2</sup> /g

## Horvath-Kawazoe

Maximum pore volume at p/p° = 0,157013262: 0,034038 cm<sup>3</sup>/g

Median pore width: 11,626 Å

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Automatic degas:	No		

## Isotherm Tabular Report

Relative Pressure (p/p°)	Absolute Pressure (kPa)	Quantity Adsorbed (mmol/g)	Elapsed Time (h:min)	Saturation Pressure (kPa)
			04:51	101.5769402
0.000000291	0.0000296	0.02703	08:08	101.7140058
0.000000941	0.0000957	0.05443	10:16	101.6601446
0.000002746	0.0002790	0.08169	13:21	101.6006362
0.000006936	0.0007039	0.10896	15:05	101.4864447
0.000015013	0.0015211	0.13601	17:17	101.3196289
0.000028953	0.0029306	0.16305	18:52	101.2190675
0.000049831	0.0050399	0.18973	20:46	101.1395900
0.000080130	0.0081698	0.21597	22:52	101.9567186
0.000124307	0.0126615	0.24229	24:07	101.8569872
0.000184993	0.0188174	0.26845	25:32	101.7193764
0.000265641	0.0269915	0.29383	26:43	101.6090420
0.000375356	0.0381275	0.31875	28:02	101.5769402
0.000524207	0.0532428	0.34355	29:23	101.5682658
0.000716069	0.0727176	0.36741	30:49	101.5511855
0.000954901	0.0969389	0.39014	32:31	101.5171632
0.001300939	0.1320609	0.41466	33:00	101.5119227
0.001767740	0.1793846	0.43995	33:38	101.4768019
0.002365681	0.2399679	0.46475	34:14	101.4371242
0.003079127	0.3122801	0.48810	35:09	101.4183920
0.003979078	0.4034997	0.51150	36:08	101.4053071
0.005045413	0.5114600	0.53360	36:41	101.3712849
0.006277955	0.6362505	0.55459	37:18	101.3467670
0.007703648	0.7803843	0.57480	38:03	101.3006201
0.009370388	0.9488479	0.59463	38:37	101.2602588
0.010678757	1.0850332	0.61178	68:45	101.6066985
0.058641044	5.9570870	0.81241	68:56	101.5856227
0.118493531	12.0353127	0.92484	69:07	101.5693643
0.157013262	15.9470677	0.98178	69:16	101.5651003
0.206313329	20.9543465	1.05055	69:26	101.5656455
0.256461909	26.0434453	1.12088	69:37	101.5489802
0.306998242	31.1774318	1.19191	69:47	101.5557342
0.354322331	35.9752155	1.26182	69:59	101.5324533
0.409874705	41.5977972	1.35303	70:18	101.4890568
0.454183006	46.0806530	1.43177	70:30	101.4583383
0.508789321	51.6048013	1.53499	70:48	101.4266595
0.559222555	56.6908791	1.63298	71:09	101.3744503
0.604055195	61.2213710	1.71482	71:22	101.3506241
0.654173743	66.2871299	1.79154	71:35	101.3295484
0.704936159	71.4231874	1.84998	71:46	101.3186606
0.754745295	76.4391172	1.89338	71:57	101.2780308

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Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

## Isotherm Tabular Report

Relative Pressure (p/p°)	Absolute Pressure (kPa)	Quantity Adsorbed (mmol/g)	Elapsed Time (h:min)	Saturation Pressure (kPa)
0.804629672	81.4856516	1.93095	72:07	101.2710001
0.854584152	86.5324708	1.96940	72:17	101.2568167
0.904187697	91.5394739	2.01546	72:27	101.2394597
0.959226858	97.0991824	2.08997	72:42	101.2265051
0.990742214	100.2672657	2.20939	72:59	101.2041924
0.884412319	89.4807723	2.04736	73:12	101.1754025
0.786771330	79.6062403	2.00527	73:22	101.1809115
0.687131597	69.5176959	1.96169	73:32	101.1708618
0.600749118	60.7665540	1.92118	73:43	101.1512996
0.497136713	50.2710931	1.77750	74:04	101.1212647
0.395160600	39.9484736	1.34478	74:24	101.0942731
0.299143148	30.2378666	1.19161	74:37	101.0815951
0.181601715	18.3524134	1.02285	74:51	101.0585908
0.153942753	15.5567717	0.98329	75:01	101.0555637

Sample: FULL- N2@77K- ADS/DES

Operator:

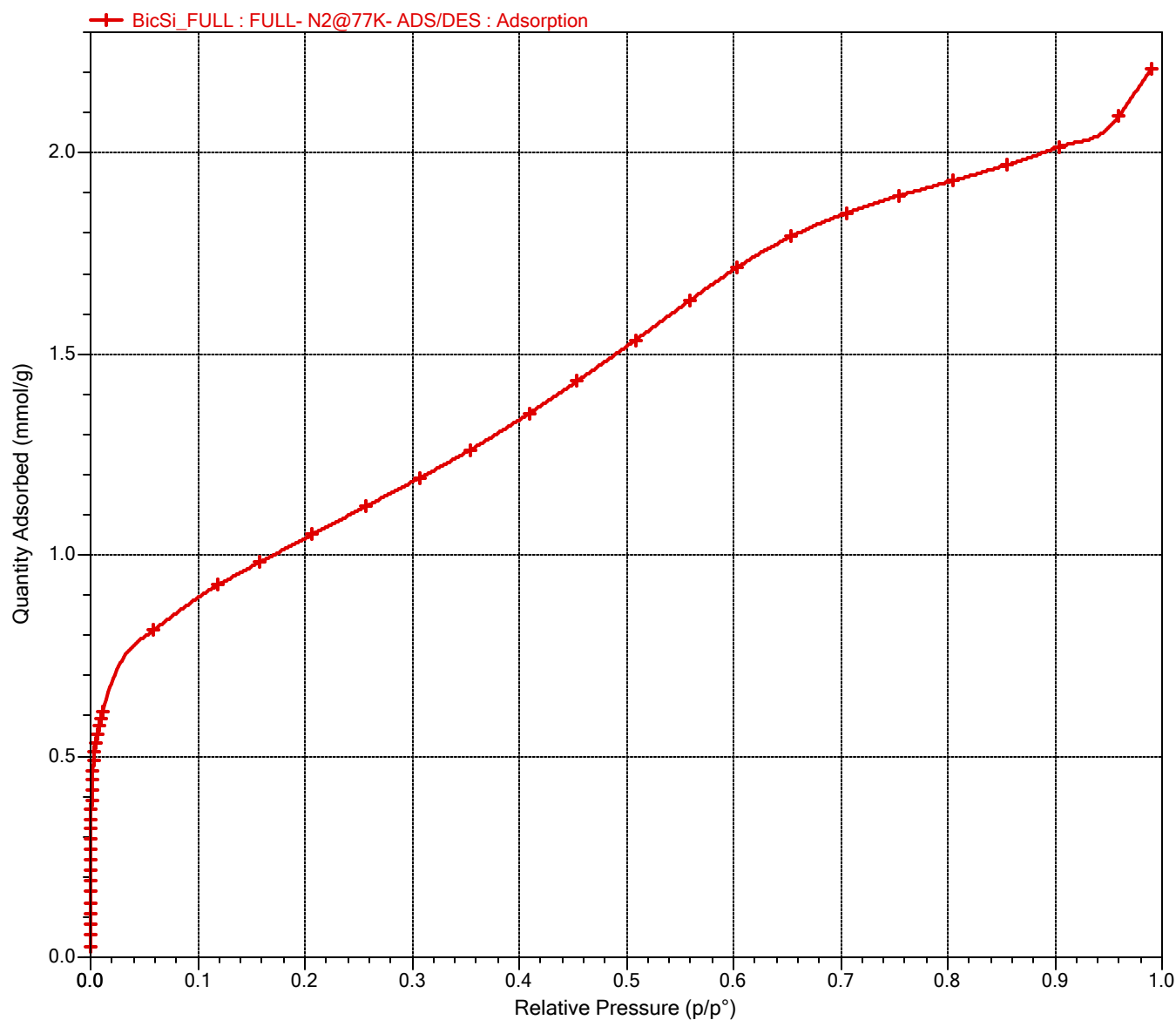
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Low pressure dose: 0,02739 mmol/g  
Automatic degas: No

Analysis adsorptive: N2  
Analysis bath temp.: 77,300 K  
Thermal correction: Yes  
Ambient free space: 28,0000 cm<sup>3</sup> Entered  
Equilibration interval: 30 s  
Sample density: 1,000 g/cm<sup>3</sup>

Isotherm Linear Plot



Sample: FULL- N2@77K- ADS/DES

Operator:

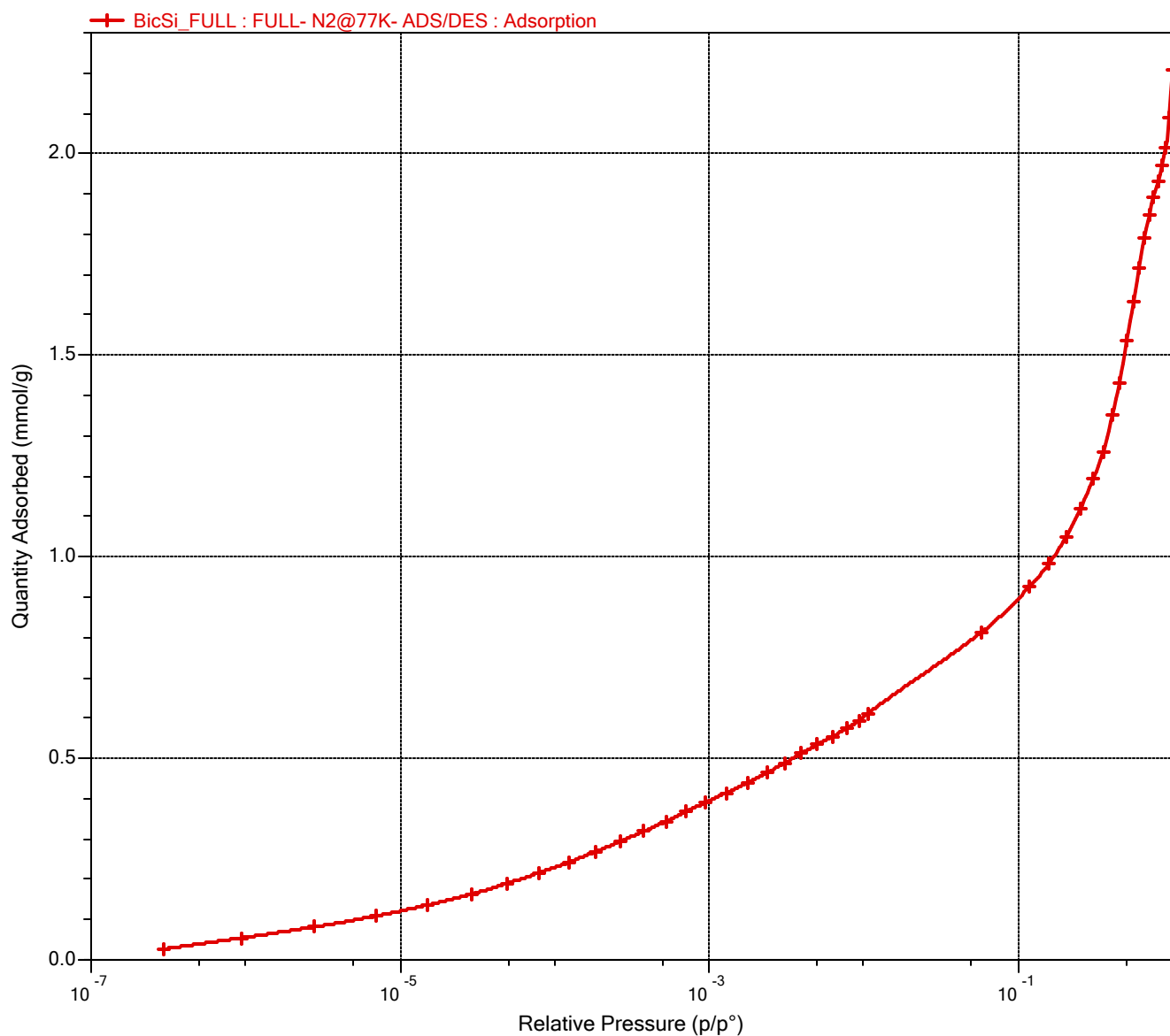
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Low pressure dose: 0,02739 mmol/g  
Automatic degas: No

Analysis adsorptive: N2  
Analysis bath temp.: 77,300 K  
Thermal correction: Yes  
Ambient free space: 28,0000 cm<sup>3</sup> Entered  
Equilibration interval: 30 s  
Sample density: 1,000 g/cm<sup>3</sup>

Isotherm Log Plot



Sample: FULL- N2@77K- ADS/DES

Operator:

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Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

## BET Report

BET surface area: 81,3367 ± 0,3466 m<sup>2</sup>/g  
 Slope: 1,19774 ± 0,00510 g/mmol  
 Y-intercept: 0,00171 ± 0,00036 g/mmol  
 C: 702,070896  
 Qm: 0,83372 mmol/g  
 Correlation coefficient: 0,9997465  
 Molecular cross-sectional area: 0,1620 nm<sup>2</sup>

Relative Pressure (p/p°)	Quantity Adsorbed (mmol/g)	1/[Q(p°/p - 1)]
0.000000291	0.02703	0.00001
0.000000941	0.05443	0.00002
0.000002746	0.08169	0.00003
0.000006936	0.10896	0.00006
0.000015013	0.13601	0.00011
0.000028953	0.16305	0.00018
0.000049831	0.18973	0.00026
0.000080130	0.21597	0.00037
0.000124307	0.24229	0.00051
0.000184993	0.26845	0.00069
0.000265641	0.29383	0.00090
0.000375356	0.31875	0.00118
0.000524207	0.34355	0.00153
0.000716069	0.36741	0.00195
0.000954901	0.39014	0.00245
0.001300939	0.41466	0.00314
0.001767740	0.43995	0.00403
0.002365681	0.46475	0.00510
0.003079127	0.48810	0.00633
0.003979078	0.51150	0.00781
0.005045413	0.53360	0.00950
0.006277955	0.55459	0.01139
0.007703648	0.57480	0.01351
0.009370388	0.59463	0.01591
0.010678757	0.61178	0.01764
0.058641044	0.81241	0.07668
0.118493531	0.92484	0.14535
0.157013262	0.98178	0.18971
0.206313329	1.05055	0.24743
0.256461909	1.12088	0.30772

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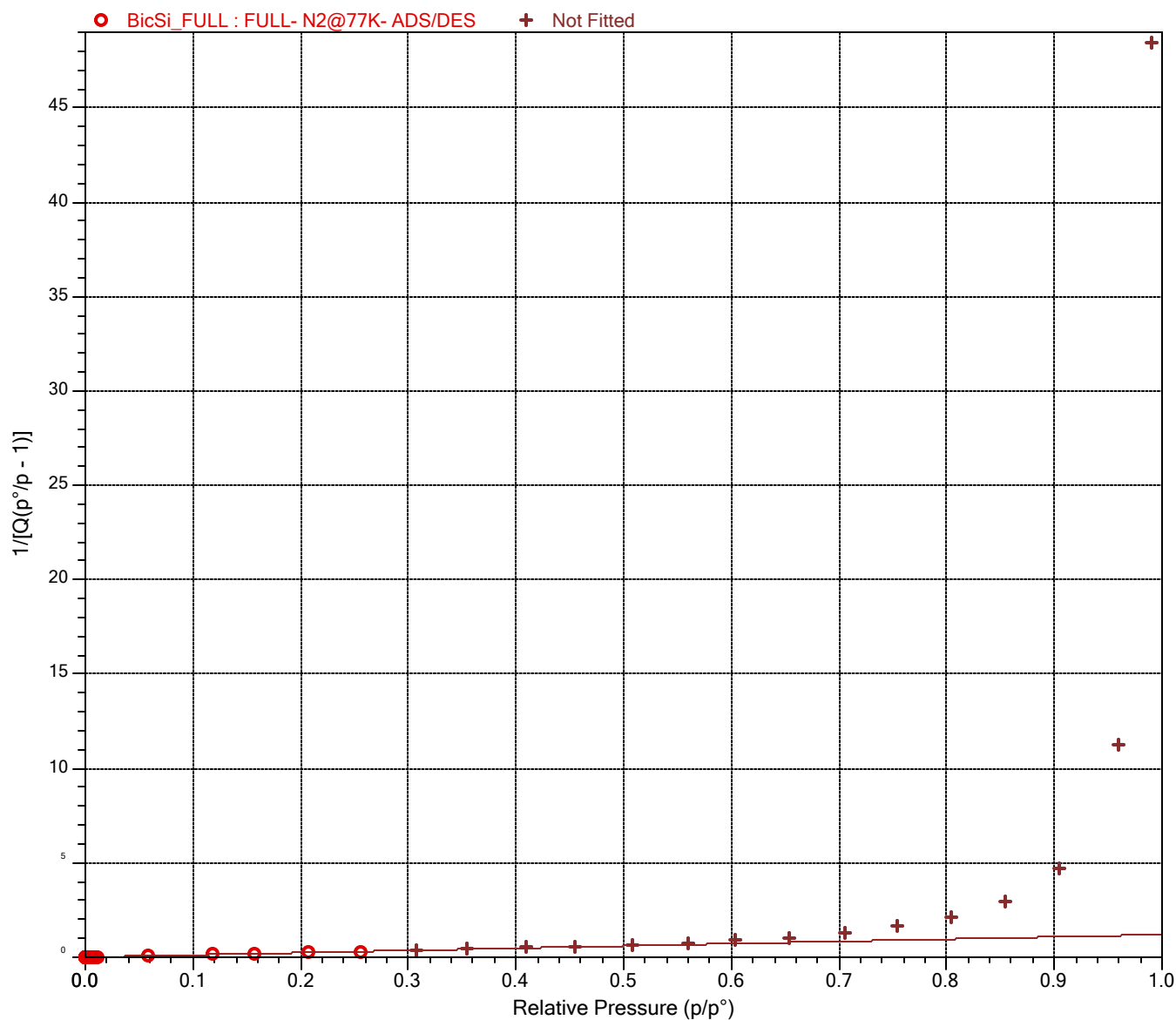
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Automatic degas: No

Analysis adsorptive: N2  
Analysis bath temp.: 77,300 K  
Thermal correction: Yes  
Ambient free space: 28,0000 cm<sup>3</sup> Entered  
Equilibration interval: 30 s  
Sample density: 1,000 g/cm<sup>3</sup>

### BET Surface Area Plot



Sample: FULL- N2@77K- ADS/DES

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Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

## t-Plot Report

Micropore volume:	0,004897 cm <sup>3</sup> /g
Micropore area:	8,8869 m <sup>2</sup> /g
External surface area:	72,4497 m <sup>2</sup> /g
Slope:	0,208969 ± 0,002447 mmol/g·Å
Y-intercept:	0,141254 ± 0,010318 mmol/g
Correlation coefficient:	0,999863
Surface area correction factor:	1,000
Density conversion factor:	0,0015468
Total surface area (BET):	81,3367 m <sup>2</sup> /g
Thickness range:	3,5000 to 5,0000 Å
Thickness equation:	Carbon Black STSA

## Thickness Curve

$$t = 2.98 + 6.45 (p/p^\circ) + 0.88 (p/p^\circ)^2$$

## t-Plot Report - Data

Relative Pressure (p/p°)	Statistical Thickness (Å)	Quantity Adsorbed (mmol/g)	Fitted
0.058641044	3.3613	0.81241	
0.118493531	3.7566	0.92484	
0.157013262	4.0144	0.98178	
0.206313329	4.3482	1.05055	
0.256461909	4.6921	1.12088	
0.306998242	5.0431	1.19191	
0.354322331	5.3759	1.26182	
0.409874705	5.7715	1.35303	
0.454183006	6.0910	1.43177	
0.508789321	6.4895	1.53499	
0.559222555	6.8622	1.63298	
0.604055195	7.1973	1.71482	
0.654173743	7.5760	1.79154	



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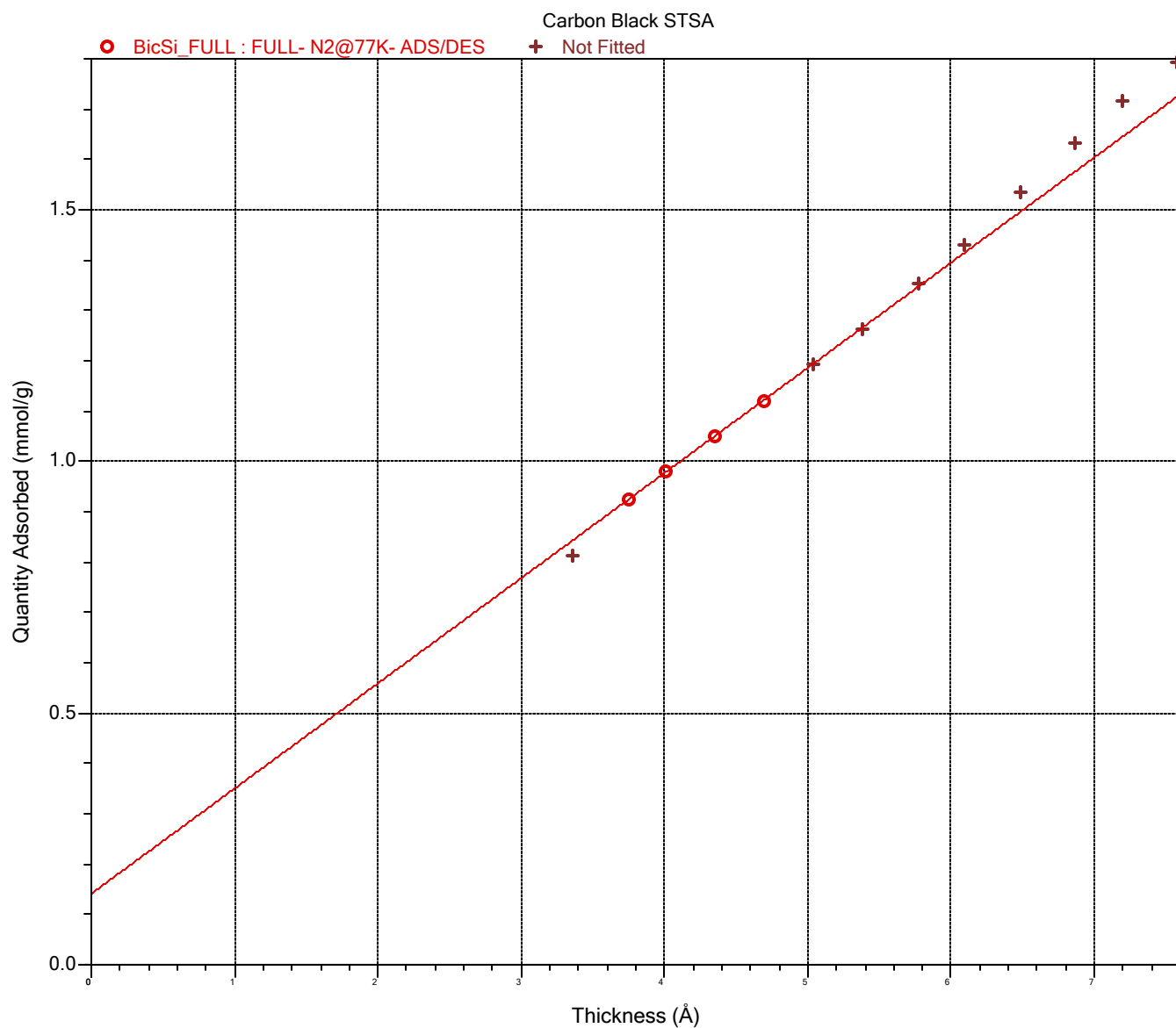
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Automatic degas: No

Analysis adsorptive: N2  
Analysis bath temp.: 77,300 K  
Thermal correction: Yes  
Ambient free space: 28,0000 cm<sup>3</sup> Entered  
Equilibration interval: 30 s  
Sample density: 1,000 g/cm<sup>3</sup>

### t-Plot



Sample: FULL- N2@77K- ADS/DES

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Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

## Horvath-Kawazoe Report

## Cylinder Pore Geometry (Saito-Foley)

Maximum pore volume: 0,034038 cm<sup>3</sup>/g  
 at Relative Pressure: 0,157013262  
 Median pore width: 11,626 Å  
 Relative pressure range: 1e-09 to 0.18

Diameter of adsorptive molecule: 3,000 Å  
 Adsorptive density: 6.710e+14 molecules/cm<sup>2</sup>  
 Adsorptive dispersion constant: 7.777e-59  
 Diameter of sample atom: 3,400 Å  
 Sample Density: 3.845e+15 molecules/cm<sup>2</sup>  
 Sample dispersion constant: 6.036e-59

Density conversion factor: 0,0015468

Absolute Pressure (kPa)	Relative Pressure (p/p°)	Quantity Adsorbed (mmol/g)	Pore Width (Å)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Smoothed Differential Pore Volume (cm <sup>3</sup> /g·Å)
0.00003	0.000000291	0.02703	5.764	0.0009	0.0028
0.00010	0.000000941	0.05443	6.112	0.0019	0.0027
0.00028	0.000002746	0.08169	6.475	0.0028	0.0026
0.00070	0.000006936	0.10896	6.833	0.0038	0.0027
0.00152	0.000015013	0.13601	7.169	0.0047	0.0029
0.00293	0.000028953	0.16305	7.489	0.0057	0.0031
0.00504	0.000049831	0.18973	7.782	0.0066	0.0032
0.00817	0.000080130	0.21597	8.063	0.0075	0.0032
0.01266	0.000124307	0.24229	8.346	0.0084	0.0032
0.01882	0.000184993	0.26845	8.625	0.0093	0.0032
0.02699	0.000265641	0.29383	8.899	0.0102	0.0031
0.03813	0.000375356	0.31875	9.183	0.0111	0.0030
0.05324	0.000524207	0.34355	9.480	0.0119	0.0028
0.07272	0.000716069	0.36741	9.780	0.0127	0.0027
0.09694	0.000954901	0.39014	10.078	0.0135	0.0025
0.13206	0.001300939	0.41466	10.426	0.0144	0.0024
0.17938	0.001767740	0.43995	10.802	0.0153	0.0023
0.23997	0.002365681	0.46475	11.192	0.0161	0.0021
0.31228	0.003079127	0.48810	11.577	0.0169	0.0020
0.40350	0.003979078	0.51150	11.985	0.0177	0.0019
0.51146	0.005045413	0.53360	12.396	0.0185	0.0018
0.63625	0.006277955	0.55459	12.806	0.0192	0.0017
0.78038	0.007703648	0.57480	13.221	0.0199	0.0016
0.94885	0.009370388	0.59463	13.652	0.0206	0.0017

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Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

Absolute Pressure (kPa)	Relative Pressure (p/p°)	Quantity Adsorbed (mmol/g)	Pore Width (Å)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Smoothed Differential Pore Volume (cm <sup>3</sup> /g·Å)
1.08503	0.010678757	0.61178	13.959	0.0212	0.0017
5.95709	0.058641044	0.81241	20.416	0.0282	0.0008
12.03531	0.118493531	0.92484	26.010	0.0321	0.0006
15.94707	0.157013262	0.98178	29.392	0.0340	0.0005

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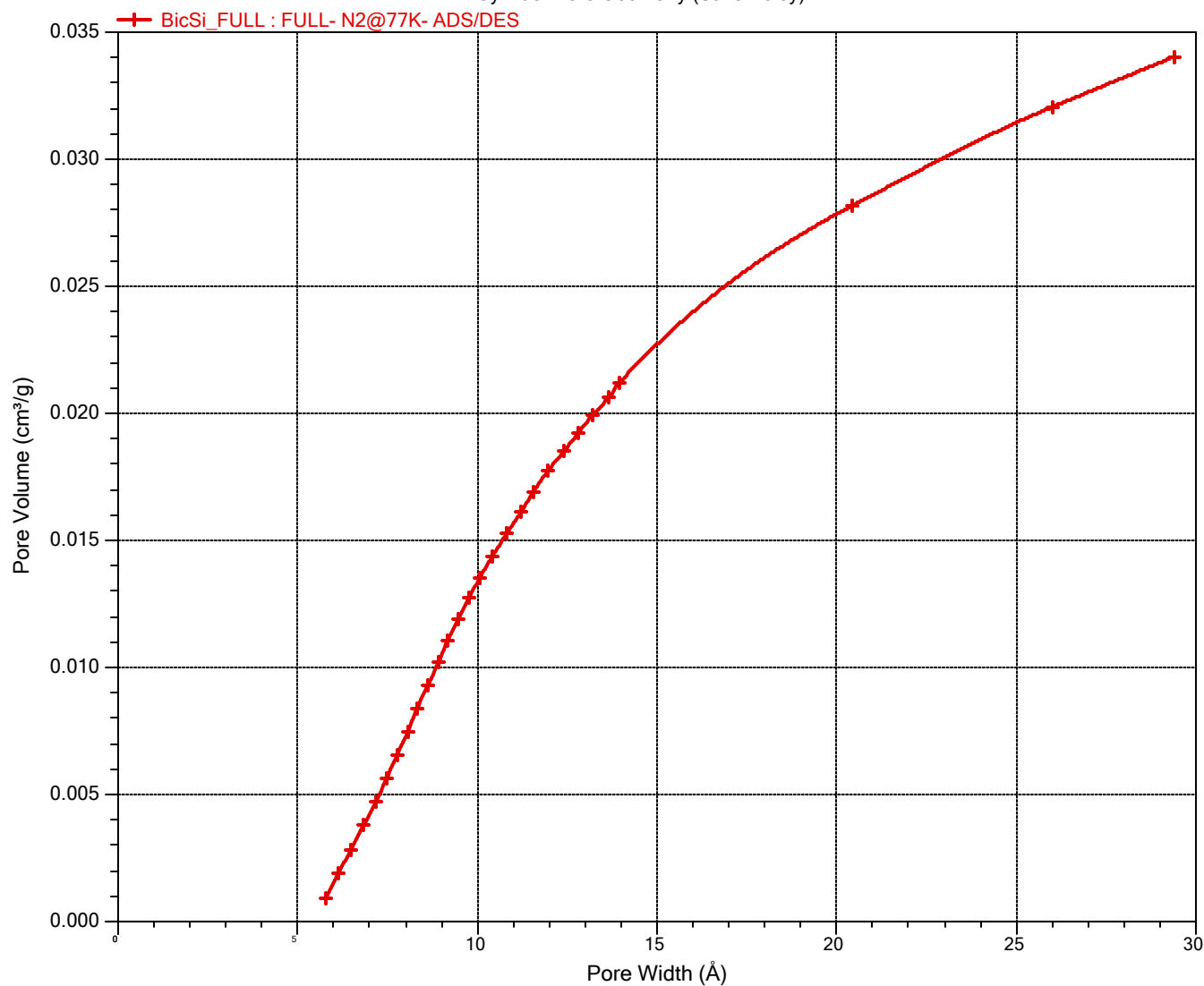
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Automatic degas: No

Analysis adsorptive: N2  
Analysis bath temp.: 77,300 K  
Thermal correction: Yes  
Ambient free space: 28,0000 cm<sup>3</sup> Entered  
Equilibration interval: 30 s  
Sample density: 1,000 g/cm<sup>3</sup>

### Horvath-Kawazoe Cumulative Pore Volume Plot

Cylinder Pore Geometry (Saito-Foley)



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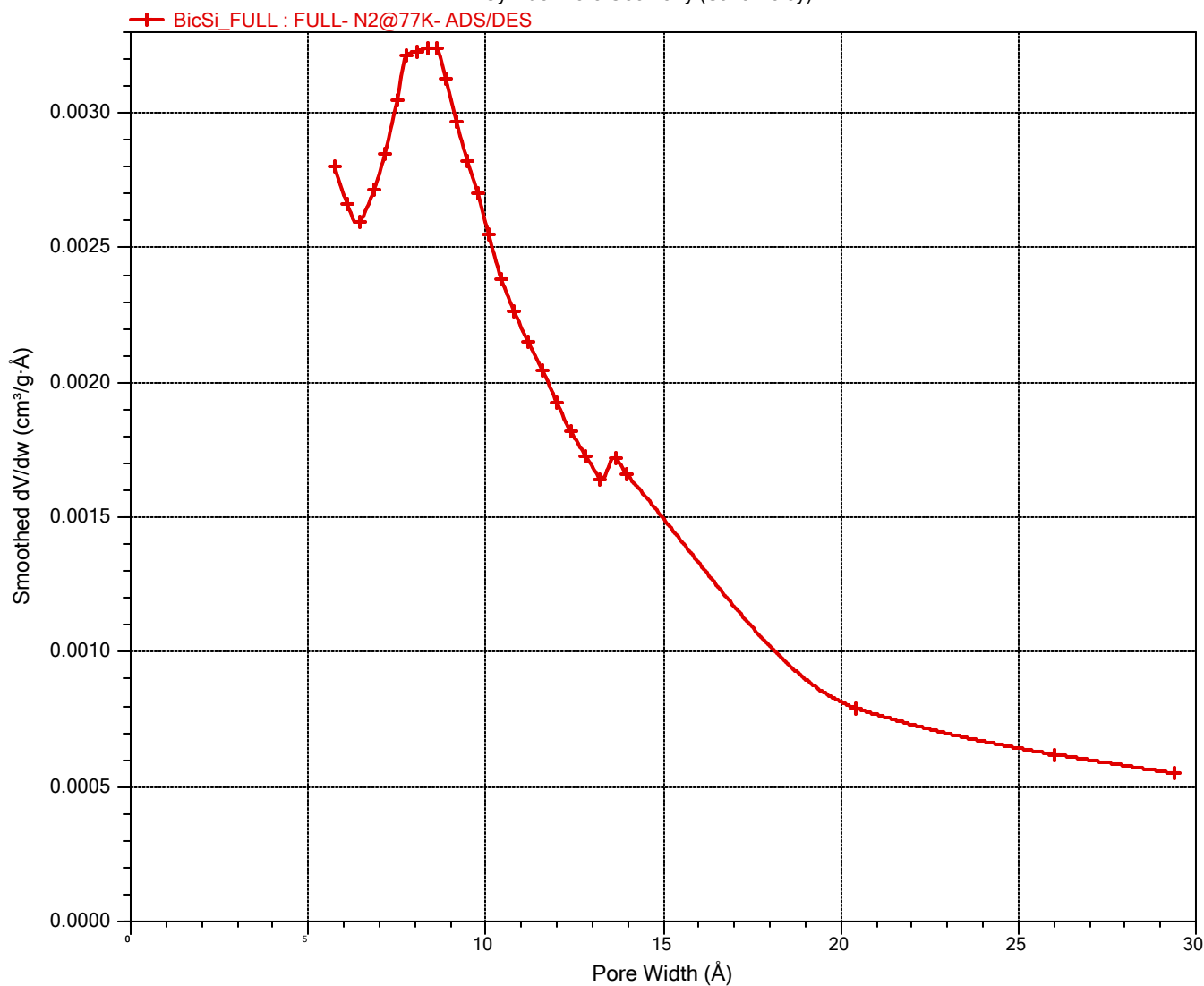
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Automatic degas: No

Analysis adsorptive: N2  
Analysis bath temp.: 77,300 K  
Thermal correction: Yes  
Ambient free space: 28,0000 cm<sup>3</sup> Entered  
Equilibration interval: 30 s  
Sample density: 1,000 g/cm<sup>3</sup>

### Horvath-Kawazoe Differential Pore Volume Plot

Cylinder Pore Geometry (Saito-Foley)



Sample: FULL- N2@77K- ADS/DES

Operator:

Submitter:

File: D:\OneDrive - Zachodniopomorski Uniwersytet Technologiczny w  
Szczecinie\Doktorat\B...\BicSi\_FULL.SMP

Started:	18.11.2022 14:39:39	Analysis adsorptive:	N2
Completed:	21.11.2022 18:42:54	Analysis bath temp.:	77,300 K
Report time:	22.11.2022 14:25:20	Thermal correction:	Yes
Sample mass:	0,8902 g	Ambient free space:	28,0000 cm <sup>3</sup> Entered
Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

Porosity Distribution by  
Model: N2 - Cylindrical Pores - Oxide Surface  
Method: Non-negative Regularization: 0,01000  
Standard Deviation of Fit: 0,005023 mmol/g

Volume in Pores	<	5,58 Å	0,00105 cm <sup>3</sup> /g
Total Volume in Pores	<=	175,73 Å	0,05473 cm <sup>3</sup> /g
Area in Pores	>	175,73 Å	10,151 m <sup>2</sup> /g
Total Area in Pores	>=	5,58 Å	71,382 m <sup>2</sup> /g

Pore Table				
Pore Width (Å)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)
5.58	0.00105	0.00000	0.000	0.000
5.93	0.00105	0.00000	0.000	0.000
6.29	0.00105	0.00000	0.000	0.000
6.65	0.00105	0.00000	0.000	0.000
7.01	0.00105	0.00000	0.000	0.000
7.36	0.00105	0.00000	0.000	0.000
7.72	0.00112	0.00008	0.398	0.398
8.08	0.00112	0.00000	0.398	0.000
8.44	0.00112	0.00000	0.398	0.000
8.79	0.00112	0.00000	0.398	0.000
9.15	0.00112	0.00000	0.398	0.000
9.51	0.00112	0.00000	0.398	0.000
9.87	0.00112	0.00000	0.398	0.000
10.22	0.00112	0.00000	0.398	0.000
10.58	0.00112	0.00000	0.398	0.000
10.94	0.00112	0.00000	0.398	0.000
11.30	0.00112	0.00000	0.398	0.000
11.65	0.00112	0.00000	0.398	0.000
12.01	0.00112	0.00000	0.398	0.000
12.37	0.00112	0.00000	0.398	0.000
12.73	0.00112	0.00000	0.398	0.000
13.08	0.00112	0.00000	0.398	0.000
13.44	0.00112	0.00000	0.398	0.000
13.80	0.00112	0.00000	0.398	0.000
14.16	0.00112	0.00000	0.398	0.000
14.51	0.00112	0.00000	0.398	0.000
14.87	0.00112	0.00000	0.398	0.000
15.23	0.00211	0.00098	2.984	2.587
15.59	0.00422	0.00211	8.397	5.413
15.94	0.00650	0.00228	14.122	5.725
16.30	0.00790	0.00140	17.553	3.430

Sample: FULL- N2@77K- ADS/DES

Operator:

Submitter:

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Sample mass:	0.8902 g	Ambient free space:	28,0000 cm <sup>3</sup> Entered
Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0.02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

Pore Width (Å)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Pore Table		
		Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)
16.66	0.00824	0.00034	18.377	0.824
17.02	0.00824	0.00000	18.377	0.000
17.37	0.00824	0.00000	18.377	0.000
17.73	0.00824	0.00000	18.377	0.000
18.09	0.00824	0.00000	18.377	0.000
18.44	0.00824	0.00000	18.377	0.000
18.80	0.00824	0.00000	18.377	0.000
19.16	0.00824	0.00000	18.377	0.000
19.52	0.00824	0.00000	18.377	0.000
19.87	0.00824	0.00000	18.377	0.000
20.23	0.00824	0.00000	18.377	0.000
20.59	0.00824	0.00000	18.377	0.000
20.95	0.00824	0.00000	18.377	0.000
21.30	0.00824	0.00000	18.377	0.000
21.66	0.00848	0.00024	18.820	0.443
22.38	0.00924	0.00076	20.181	1.361
23.09	0.01028	0.00104	21.977	1.796
23.81	0.01110	0.00082	23.353	1.377
24.52	0.01160	0.00050	24.174	0.821
25.24	0.01197	0.00037	24.765	0.591
25.95	0.01226	0.00028	25.203	0.437
26.67	0.01242	0.00017	25.452	0.249
27.38	0.01271	0.00029	25.880	0.428
28.10	0.01316	0.00045	26.518	0.638
28.81	0.01346	0.00030	26.932	0.414
29.53	0.01387	0.00041	27.490	0.559
30.24	0.01462	0.00075	28.481	0.991
30.96	0.01544	0.00082	29.540	1.058
31.67	0.01592	0.00047	30.138	0.598
32.39	0.01646	0.00054	30.808	0.671
33.10	0.01739	0.00093	31.936	1.128
33.82	0.01808	0.00069	32.748	0.812
34.53	0.01849	0.00041	33.224	0.476
35.25	0.01887	0.00038	33.651	0.427
35.96	0.01960	0.00073	34.465	0.813
36.68	0.02071	0.00112	35.683	1.218
37.39	0.02149	0.00078	36.518	0.835
38.11	0.02204	0.00055	37.093	0.574
38.82	0.02267	0.00063	37.740	0.647
39.54	0.02342	0.00075	38.495	0.755
40.25	0.02416	0.00074	39.232	0.736

Sample: FULL- N2@77K- ADS/DES

Operator:

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Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0.02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

Pore Width (Å)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Pore Table		
		Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)
40.96	0.02491	0.00075	39.964	0.733
41.68	0.02569	0.00078	40.711	0.747
42.39	0.02651	0.00083	41.491	0.780
43.11	0.02735	0.00083	42.265	0.774
43.82	0.02819	0.00085	43.037	0.772
44.54	0.02904	0.00084	43.796	0.759
45.25	0.02991	0.00088	44.569	0.774
45.97	0.03080	0.00089	45.340	0.771
46.68	0.03168	0.00088	46.094	0.754
47.40	0.03247	0.00079	46.763	0.669
48.11	0.03309	0.00062	47.275	0.513
48.83	0.03350	0.00041	47.615	0.340
49.54	0.03396	0.00046	47.983	0.368
50.26	0.03533	0.00137	49.075	1.092
52.05	0.03801	0.00268	51.134	2.059
54.91	0.04065	0.00264	53.058	1.924
57.77	0.04239	0.00174	54.260	1.202
60.98	0.04475	0.00237	55.813	1.553
64.20	0.04692	0.00216	57.160	1.348
67.42	0.04880	0.00188	58.279	1.118
70.99	0.05039	0.00159	59.172	0.893
74.57	0.05124	0.00086	59.632	0.460
78.50	0.05227	0.00103	60.155	0.523
82.79	0.05309	0.00082	60.551	0.396
87.08	0.05349	0.00040	60.736	0.185
91.37	0.05379	0.00030	60.868	0.131
96.37	0.05415	0.00036	61.015	0.148
101.38	0.05442	0.00027	61.123	0.107
106.38	0.05454	0.00012	61.166	0.043
112.10	0.05461	0.00007	61.193	0.026
117.82	0.05469	0.00008	61.218	0.026
123.90	0.05473	0.00004	61.232	0.013
130.33	0.05473	0.00000	61.232	0.000
136.76	0.05473	0.00000	61.232	0.000
143.91	0.05473	0.00000	61.232	0.000
151.06	0.05473	0.00000	61.232	0.000
158.93	0.05473	0.00000	61.232	0.000
167.15	0.05473	0.00000	61.232	0.000
175.73	0.05473	0.00000	61.232	0.000



Sample: FULL- N2@77K- ADS/DES

Operator:

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Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

Porosity Distribution by  
Model: N2 - Cylindrical Pores - Oxide Surface  
Method: Non-negative Regularization: 0,01000  
Standard Deviation of Fit: 0,005023 mmol/g

Isotherm Table				
Relative Pressure (p/p°)	Experimental Quantity Adsorbed (mmol/g)	Fitted Quantity Adsorbed (mmol/g)	Absolute Residual (mmol/g)	Relative Residual
0.000000316	0.02841	0.03985	-0.01144	-0.402711
0.000000398	0.03284	0.04132	-0.00848	-0.258318
0.000000501	0.03812	0.04285	-0.00473	-0.124054
0.000000631	0.04413	0.04472	-0.00059	-0.013349
0.000000794	0.05039	0.04672	0.00367	0.072863
0.000001000	0.05569	0.04885	0.00684	0.122892
0.000001259	0.06099	0.05138	0.00961	0.157577
0.000001585	0.06703	0.05458	0.01245	0.185758
0.000001995	0.07351	0.05881	0.01470	0.199949
0.000002512	0.07969	0.06464	0.01505	0.188889
0.000003162	0.08480	0.07249	0.01231	0.145191
0.000003981	0.09098	0.08177	0.00921	0.101237
0.000005012	0.09840	0.09141	0.00699	0.071046
0.000006310	0.10619	0.10100	0.00519	0.048867
0.000007943	0.11281	0.11036	0.00245	0.021683
0.000010000	0.12059	0.11969	0.00090	0.007473
0.000012589	0.12951	0.12928	0.00023	0.001764
0.000015849	0.13784	0.13935	-0.00151	-0.010982
0.000019953	0.14667	0.14983	-0.00315	-0.021488
0.000025119	0.15683	0.16072	-0.00389	-0.024804
0.000031623	0.16685	0.17200	-0.00514	-0.030823
0.000039811	0.17809	0.18371	-0.00562	-0.031566
0.000050119	0.19001	0.19589	-0.00587	-0.030902
0.000063096	0.20235	0.20856	-0.00621	-0.030693
0.000079433	0.21550	0.22170	-0.00620	-0.028786
0.000100000	0.22884	0.23526	-0.00642	-0.028052
0.000125892	0.24305	0.24928	-0.00623	-0.025618
0.000158490	0.25798	0.26376	-0.00578	-0.022387
0.000199526	0.27354	0.27878	-0.00524	-0.019173
0.000251188	0.28992	0.29428	-0.00435	-0.015017
0.000316228	0.30627	0.31030	-0.00402	-0.013137
0.000398107	0.32295	0.32671	-0.00376	-0.011633
0.000501187	0.34024	0.34357	-0.00333	-0.009783
0.000630958	0.35760	0.36080	-0.00320	-0.008939
0.000794328	0.37550	0.37849	-0.00298	-0.007948

Sample: FULL- N2@77K- ADS/DES

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Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

Isotherm Table

Relative Pressure (p/p°)	Experimental Quantity Adsorbed (mmol/g)	Fitted Quantity Adsorbed (mmol/g)	Absolute Residual (mmol/g)	Relative Residual
0.001000000	0.39369	0.39656	-0.00287	-0.007288
0.001258925	0.41208	0.41511	-0.00303	-0.007346
0.001584895	0.43086	0.43407	-0.00322	-0.007464
0.001995263	0.45007	0.45352	-0.00345	-0.007672
0.002511882	0.46991	0.47343	-0.00352	-0.007485
0.003162276	0.49046	0.49383	-0.00337	-0.006865
0.003981066	0.51154	0.51472	-0.00318	-0.006220
0.005011868	0.53299	0.53615	-0.00316	-0.005937
0.006309579	0.55507	0.55825	-0.00318	-0.005731
0.007943276	0.57777	0.58114	-0.00337	-0.005840
0.010000000	0.60320	0.60492	-0.00171	-0.002839
0.012355640	0.62805	0.62739	0.00066	0.001054
0.015186320	0.65311	0.65151	0.00160	0.002449
0.018485530	0.67877	0.67525	0.00352	0.005184
0.022294740	0.70407	0.69753	0.00654	0.009285
0.026653420	0.72796	0.71820	0.00976	0.013412
0.031598160	0.74951	0.73820	0.01131	0.015089
0.037162240	0.76805	0.75753	0.01053	0.013707
0.043374470	0.78356	0.77660	0.00696	0.008883
0.050259210	0.79701	0.79543	0.00158	0.001980
0.057835260	0.81084	0.81373	-0.00289	-0.003564
0.066115920	0.82733	0.83154	-0.00421	-0.005089
0.075109080	0.84547	0.84883	-0.00336	-0.003975
0.084815920	0.86489	0.86554	-0.00065	-0.000751
0.095232370	0.88505	0.88487	0.00018	0.000207
0.106348200	0.90521	0.90457	0.00063	0.000699
0.118147500	0.92433	0.92392	0.00040	0.000436
0.130609100	0.94305	0.94302	0.00002	0.000026
0.143706600	0.96262	0.96258	0.00004	0.000038
0.157410500	0.98234	0.98205	0.00029	0.000292
0.171685500	1.00224	1.00234	-0.00010	-0.000104
0.186492100	1.02286	1.02250	0.00036	0.000356
0.201792100	1.04422	1.04430	-0.00008	-0.000079
0.217539500	1.06629	1.06632	-0.00003	-0.000026
0.233689500	1.08894	1.08863	0.00031	0.000287
0.250196100	1.11209	1.11234	-0.00026	-0.000231
0.267011800	1.13568	1.13544	0.00024	0.000210
0.284089500	1.15968	1.15963	0.00005	0.000046
0.301380300	1.18400	1.18415	-0.00014	-0.000120
0.318838200	1.20880	1.20861	0.00019	0.000157

Sample: FULL- N2@77K- ADS/DES

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Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

Isotherm Table

Relative Pressure (p/p°)	Experimental Quantity Adsorbed (mmol/g)	Fitted Quantity Adsorbed (mmol/g)	Absolute Residual (mmol/g)	Relative Residual
0.336417100	1.23468	1.23471	-0.00003	-0.000024
0.354071100	1.26144	1.26140	0.00003	0.000027
0.371757900	1.28927	1.28925	0.00001	0.000010
0.389435500	1.31830	1.31829	0.00001	0.000011
0.407065800	1.34820	1.34818	0.00001	0.000009
0.424610500	1.37858	1.37857	0.00001	0.000008
0.442034200	1.40952	1.40952	0.00000	0.000003
0.459305300	1.44131	1.44125	0.00005	0.000037
0.476393400	1.47336	1.47346	-0.00010	-0.000065
0.493271100	1.50535	1.51578	-0.01043	-0.006928
0.509911800	1.53714	1.52649	0.01065	0.006927
0.526293400	1.56887	1.56874	0.00012	0.000079
0.542394700	1.60031	1.60049	-0.00018	-0.000110
0.558200000	1.63101	1.64100	-0.00999	-0.006128
0.573690800	1.66027	1.65007	0.01020	0.006143
0.588853900	1.68787	1.68791	-0.00003	-0.000020
0.603677600	1.71416	1.72239	-0.00823	-0.004800
0.618153900	1.73860	1.73032	0.00828	0.004763
0.632272400	1.76058	1.76056	0.00002	0.000010
0.646028900	1.78044	1.78051	-0.00007	-0.000041
0.659417100	1.79846	1.80317	-0.00471	-0.002621
0.672435500	1.81484	1.81010	0.00475	0.002617
0.685081600	1.82957	1.82959	-0.00002	-0.000011
0.697355300	1.84260	1.84263	-0.00003	-0.000015
0.709256600	1.85402	1.85404	-0.00003	-0.000014
0.720789500	1.86466	1.86645	-0.00179	-0.000960
0.731953900	1.87464	1.87286	0.00179	0.000954
0.742756600	1.88385	1.88387	-0.00002	-0.000009
0.753200000	1.89220	1.89222	-0.00002	-0.000010
0.763289500	1.89983	1.89985	-0.00002	-0.000008
0.773030300	1.90713	1.90752	-0.00039	-0.000203
0.782430300	1.91416	1.91378	0.00038	0.000197
0.791496100	1.92096	1.92077	0.00019	0.000100
0.800232900	1.92758	1.92696	0.00063	0.000325
0.808648700	1.93405	1.93315	0.00090	0.000463
0.816752600	1.94028	1.93934	0.00095	0.000488
0.824552600	1.94629	1.94552	0.00077	0.000397
0.832053900	1.95206	1.95168	0.00038	0.000195
0.839267100	1.95761	1.95787	-0.00026	-0.000131
0.846200000	1.96295	1.96419	-0.00125	-0.000634

Sample: FULL- N2@77K- ADS/DES

Operator:

Submitter:

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Completed:	21.11.2022 18:42:54	Analysis bath temp.:	77,300 K
Report time:	22.11.2022 14:25:20	Thermal correction:	Yes
Sample mass:	0,8902 g	Ambient free space:	28,0000 cm <sup>3</sup> Entered
Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

Isotherm Table

Relative Pressure (p/p°)	Experimental Quantity Adsorbed (mmol/g)	Fitted Quantity Adsorbed (mmol/g)	Absolute Residual (mmol/g)	Relative Residual
0.852860500	1.96808	1.97055	-0.00248	-0.001258

Sample: FULL- N2@77K- ADS/DES

Operator:

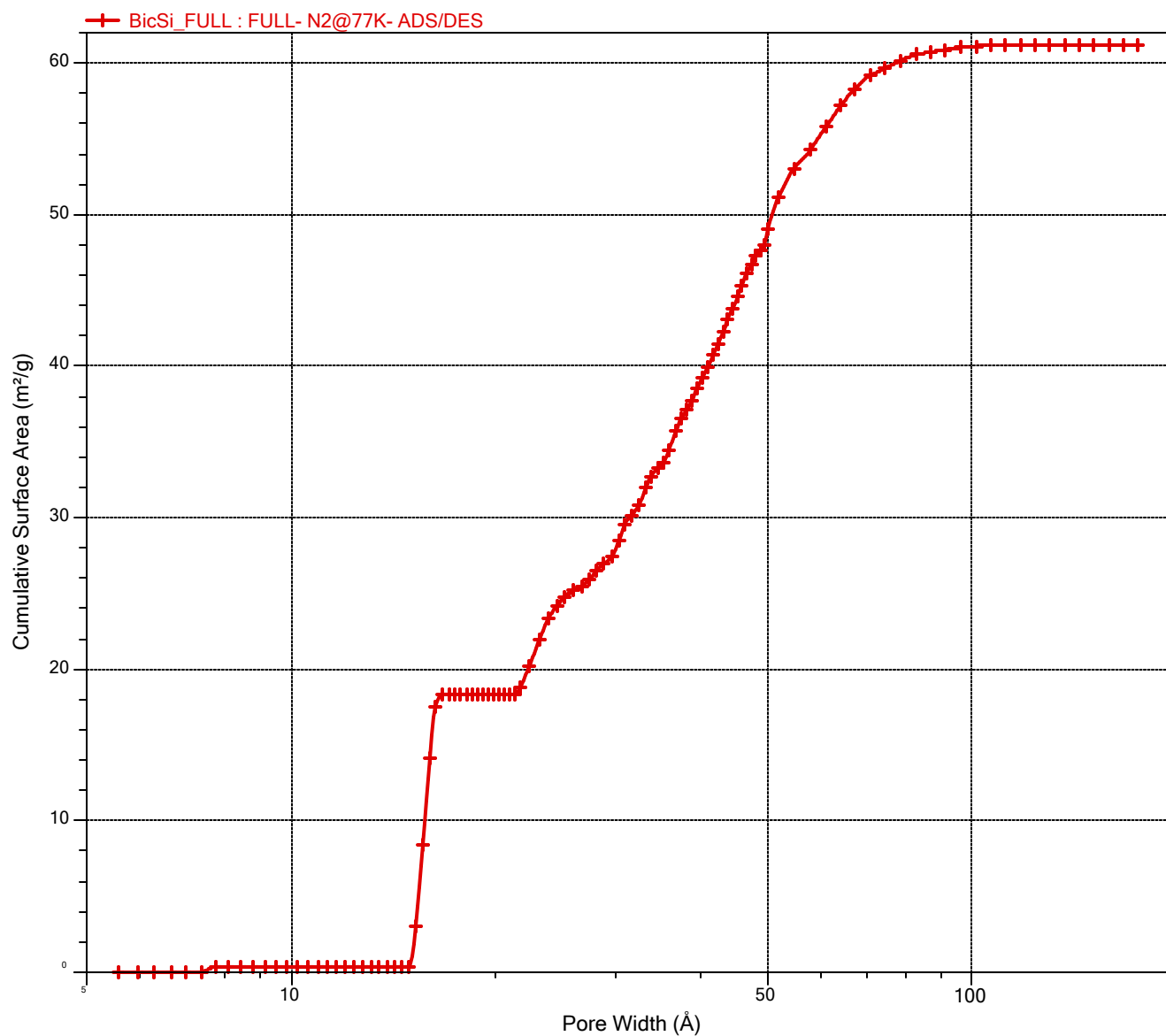
Submitter:

File: D:\OneDrive - Zachodniopomorski Uniwersytet Technologiczny w  
Szczecinie\Doktorat\B...\BicSi\_FULL.SMP

Started: 18.11.2022 14:39:39  
Completed: 21.11.2022 18:42:54  
Report time: 22.11.2022 14:25:20  
Sample mass: 0,8902 g  
Analysis free space: 83,0000 cm<sup>3</sup>  
Low pressure dose: 0,02739 mmol/g  
Automatic degas: No

Analysis adsorptive: N2  
Analysis bath temp.: 77,300 K  
Thermal correction: Yes  
Ambient free space: 28,0000 cm<sup>3</sup> Entered  
Equilibration interval: 30 s  
Sample density: 1,000 g/cm<sup>3</sup>

Cumulative Surface Area vs. Pore Width



Sample: FULL- N2@77K- ADS/DES

Operator:

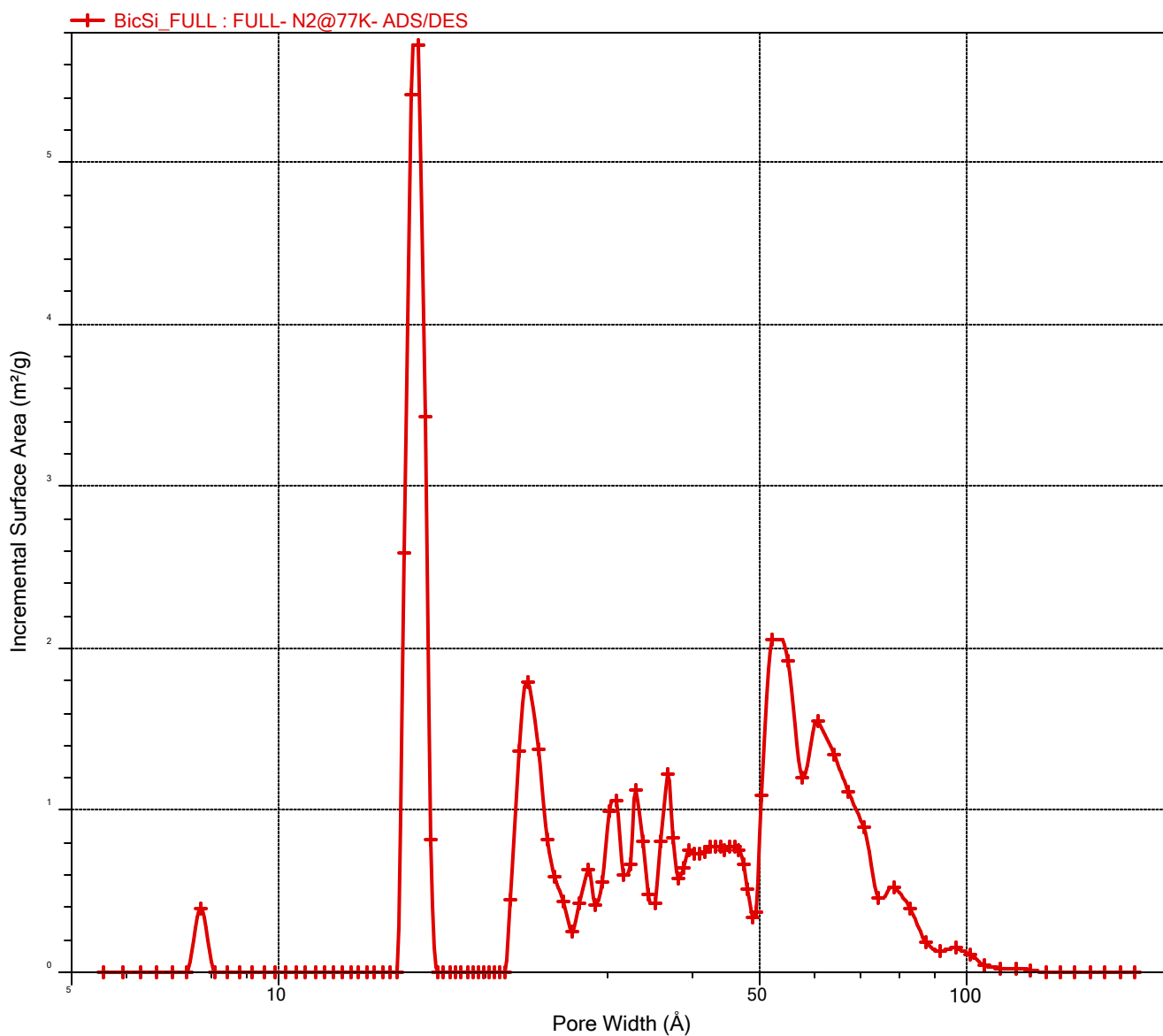
Submitter:

File: D:\OneDrive - Zachodniopomorski Uniwersytet Technologiczny w  
Szczecinie\Doktorat\B...\BicSi\_FULL.SMP

Started: 18.11.2022 14:39:39  
Completed: 21.11.2022 18:42:54  
Report time: 22.11.2022 14:25:20  
Sample mass: 0,8902 g  
Analysis free space: 83,0000 cm<sup>3</sup>  
Low pressure dose: 0,02739 mmol/g  
Automatic degas: No

Analysis adsorptive: N2  
Analysis bath temp.: 77,300 K  
Thermal correction: Yes  
Ambient free space: 28,0000 cm<sup>3</sup> Entered  
Equilibration interval: 30 s  
Sample density: 1,000 g/cm<sup>3</sup>

### Incremental Surface Area vs. Pore Width



Sample: FULL- N2@77K- ADS/DES

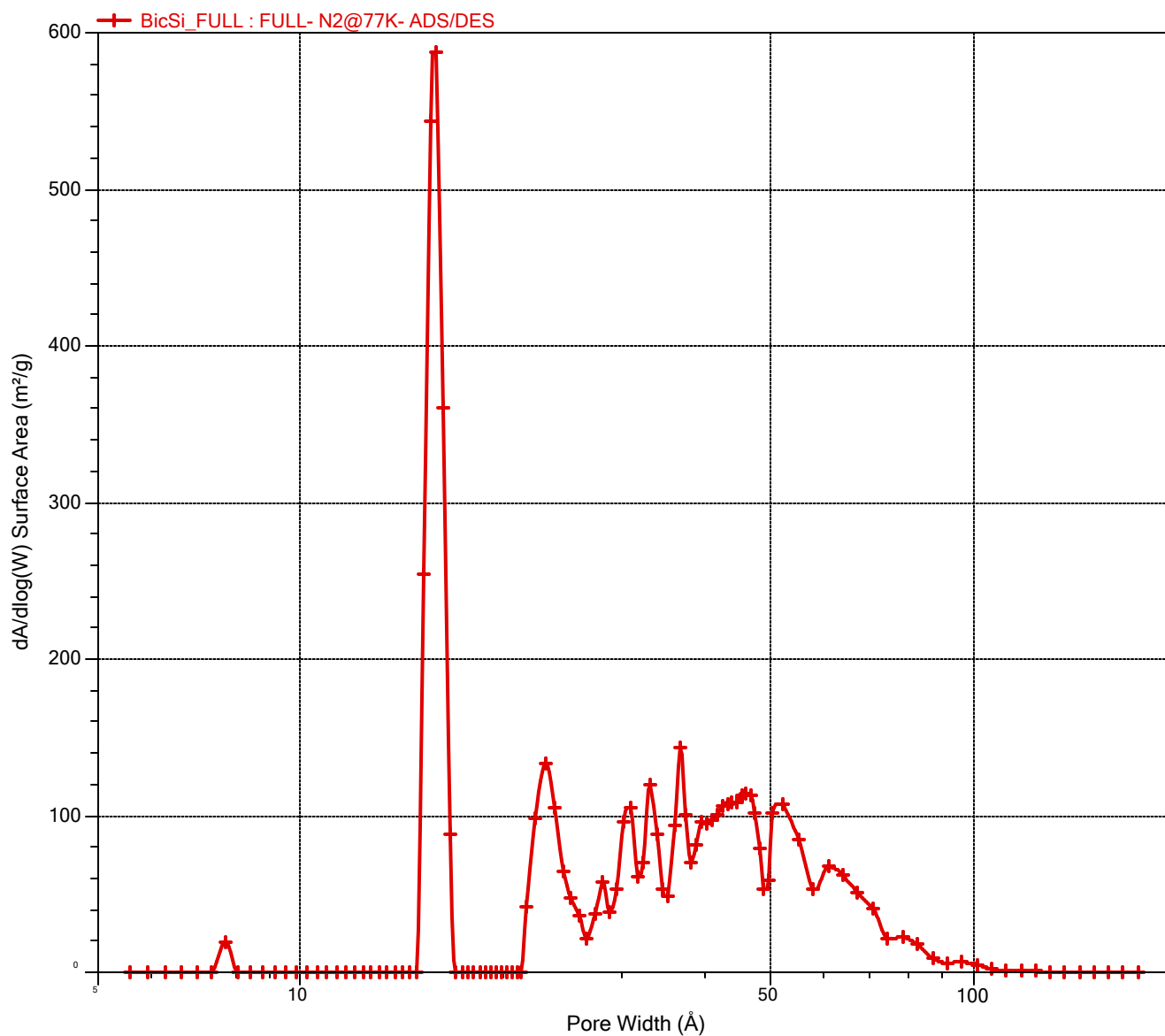
Operator:

Submitter:

File: D:\OneDrive - Zachodniopomorski Uniwersytet Technologiczny w  
Szczecinie\Doktorat\B...\BicSi\_FULL.SMP

Started:	18.11.2022 14:39:39	Analysis adsorptive:	N2
Completed:	21.11.2022 18:42:54	Analysis bath temp.:	77,300 K
Report time:	22.11.2022 14:25:20	Thermal correction:	Yes
Sample mass:	0,8902 g	Ambient free space:	28,0000 cm <sup>3</sup> Entered
Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

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



Sample: FULL- N2@77K- ADS/DES

Operator:

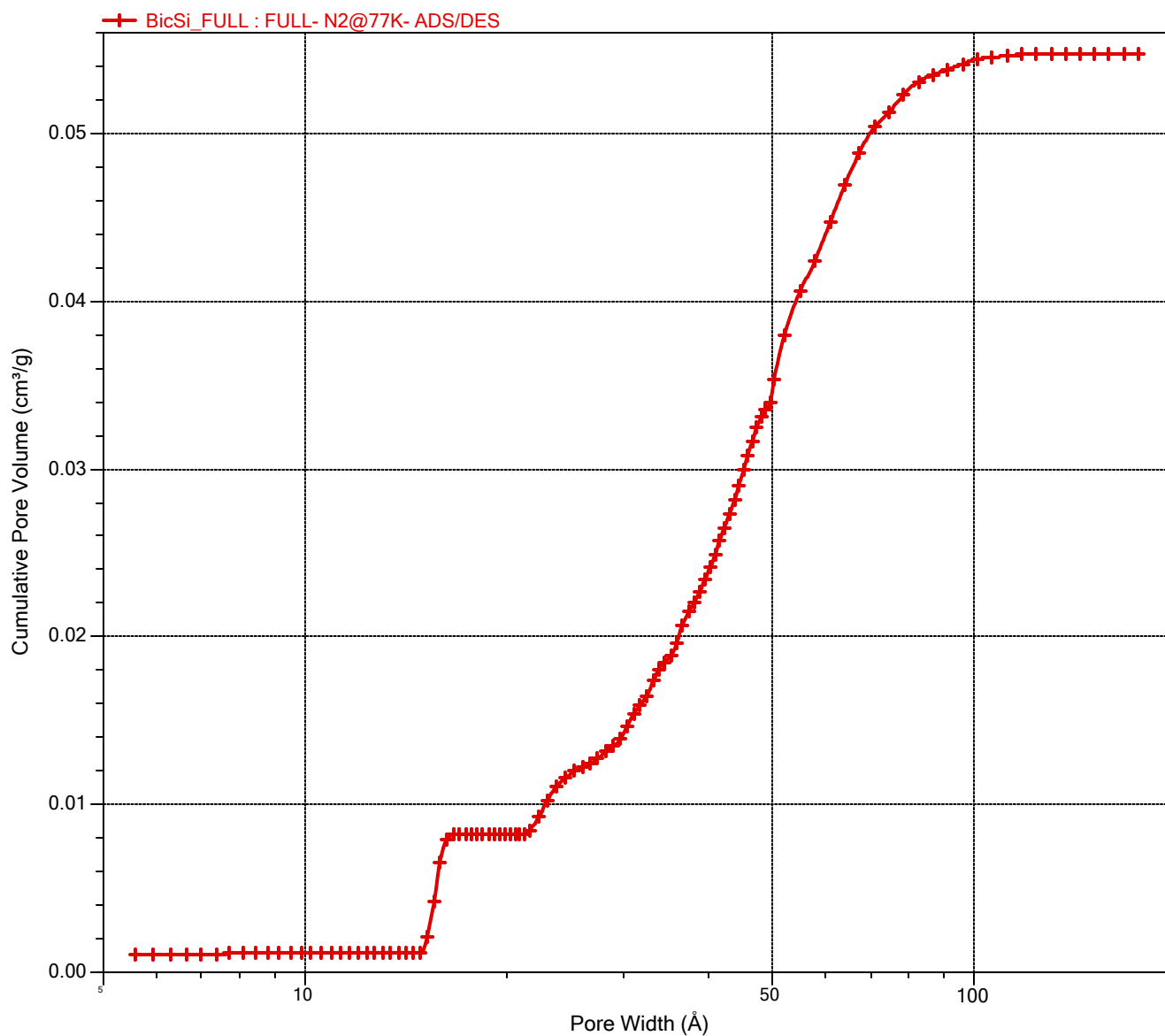
Submitter:

File: D:\OneDrive - Zachodniopomorski Uniwersytet Technologiczny w  
Szczecinie\Doktorat\B...\BicSi\_FULL.SMP

Started: 18.11.2022 14:39:39  
Completed: 21.11.2022 18:42:54  
Report time: 22.11.2022 14:25:20  
Sample mass: 0,8902 g  
Analysis free space: 83,0000 cm<sup>3</sup>  
Low pressure dose: 0,02739 mmol/g  
Automatic degas: No

Analysis adsorptive: N2  
Analysis bath temp.: 77,300 K  
Thermal correction: Yes  
Ambient free space: 28,0000 cm<sup>3</sup> Entered  
Equilibration interval: 30 s  
Sample density: 1,000 g/cm<sup>3</sup>

Cumulative Pore Volume vs. Pore Width





Sample: FULL- N2@77K- ADS/DES

Operator:

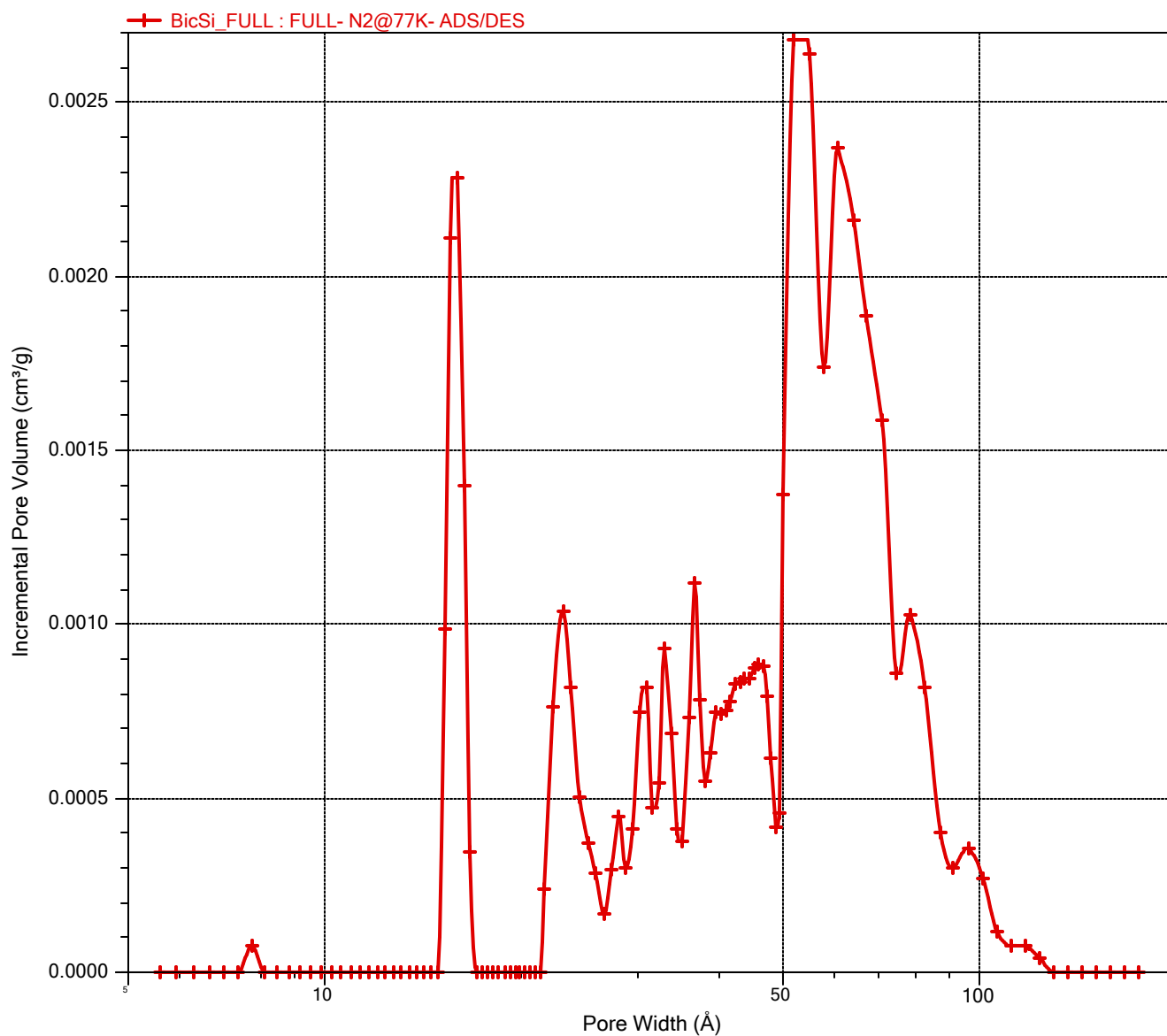
Submitter:

File: D:\OneDrive - Zachodniopomorski Uniwersytet Technologiczny w  
Szczecinie\Doktorat\B...\BicSi\_FULL.SMP

Started: 18.11.2022 14:39:39  
 Completed: 21.11.2022 18:42:54  
 Report time: 22.11.2022 14:25:20  
 Sample mass: 0,8902 g  
 Analysis free space: 83,0000 cm<sup>3</sup>  
 Low pressure dose: 0,02739 mmol/g  
 Automatic degas: No

Analysis adsorptive: N2  
 Analysis bath temp.: 77,300 K  
 Thermal correction: Yes  
 Ambient free space: 28,0000 cm<sup>3</sup> Entered  
 Equilibration interval: 30 s  
 Sample density: 1,000 g/cm<sup>3</sup>

## Incremental Pore Volume vs. Pore Width



Sample: FULL- N2@77K- ADS/DES

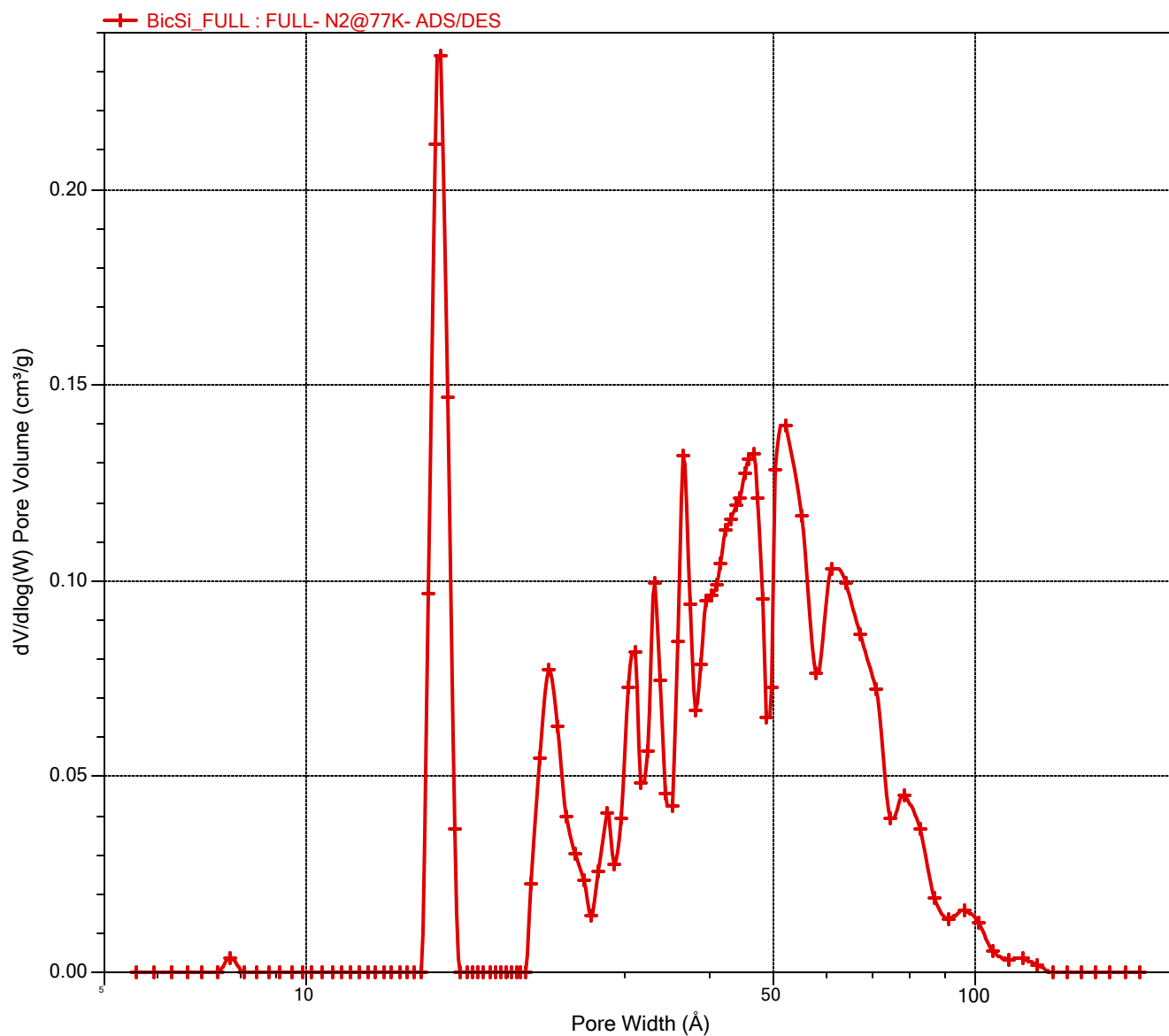
Operator:

Submitter:

File: D:\OneDrive - Zachodniopomorski Uniwersytet Technologiczny w  
Szczecinie\Doktorat\B...\BicSi\_FULL.SMP

Started:	18.11.2022 14:39:39	Analysis adsorptive:	N2
Completed:	21.11.2022 18:42:54	Analysis bath temp.:	77,300 K
Report time:	22.11.2022 14:25:20	Thermal correction:	Yes
Sample mass:	0,8902 g	Ambient free space:	28,0000 cm <sup>3</sup> Entered
Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

dV/dlog(W) Pore Volume vs. Pore Width



Sample: FULL- N2@77K- ADS/DES

Operator:

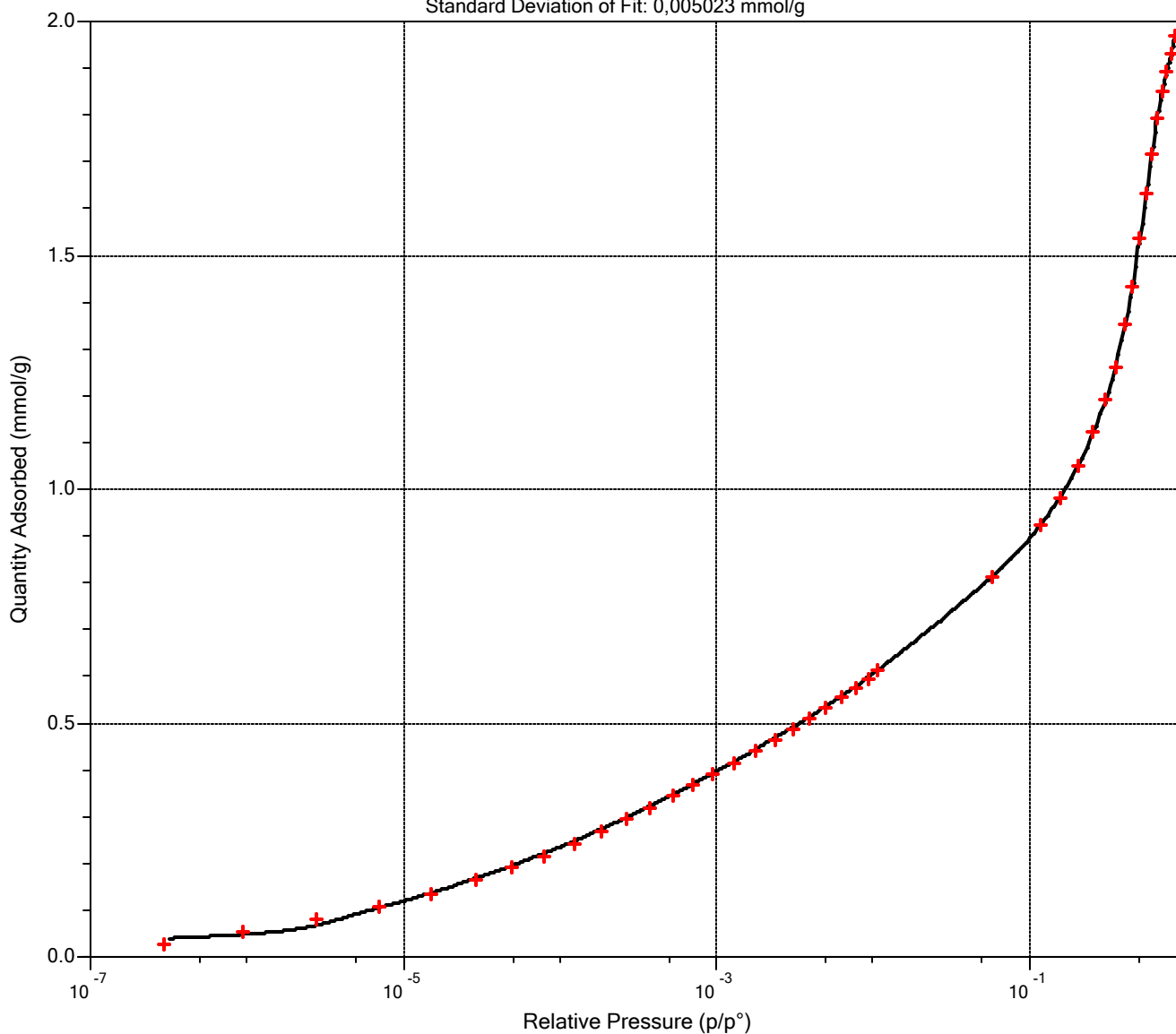
Submitter:

File: D:\OneDrive - Zachodniopomorski Uniwersytet Technologiczny w  
Szczecinie\Doktorat\B...\BicSi\_FULL.SMP

Started:	18.11.2022 14:39:39	Analysis adsorptive:	N2
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Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

### Goodness of Fit

Standard Deviation of Fit: 0,005023 mmol/g



Sample: FULL- N2@77K- ADS/DES

Operator:

Submitter:

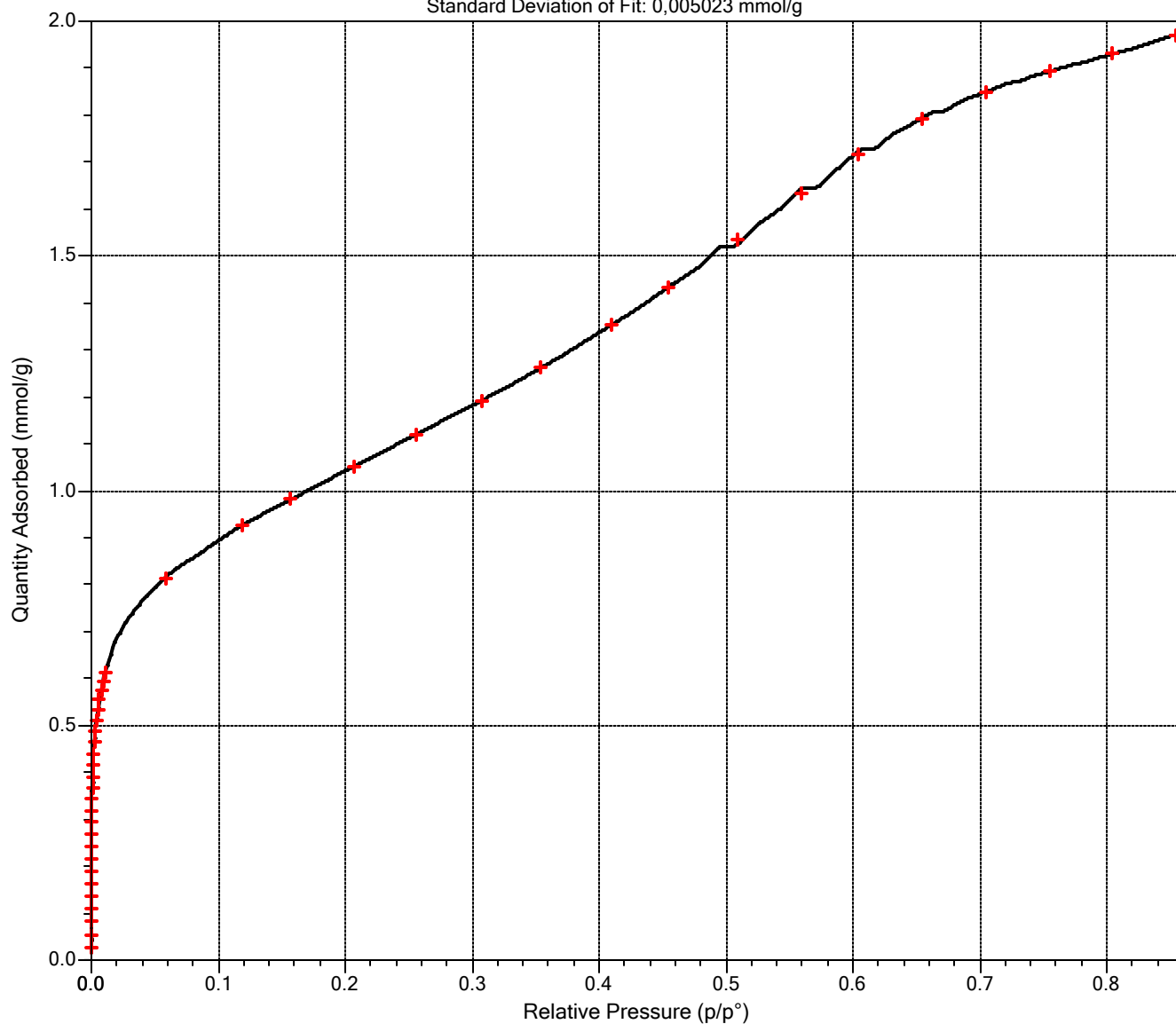
File: D:\OneDrive - Zachodniopomorski Uniwersytet Technologiczny w  
Szczecinie\Doktorat\B...\BicSi\_FULL.SMP

Started: 18.11.2022 14:39:39  
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Report time: 22.11.2022 14:25:20  
Sample mass: 0,8902 g  
Analysis free space: 83,0000 cm<sup>3</sup>  
Low pressure dose: 0,02739 mmol/g  
Automatic degas: No

Analysis adsorptive: N2  
Analysis bath temp.: 77,300 K  
Thermal correction: Yes  
Ambient free space: 28,0000 cm<sup>3</sup> Entered  
Equilibration interval: 30 s  
Sample density: 1,000 g/cm<sup>3</sup>

### Goodness of Fit

Standard Deviation of Fit: 0,005023 mmol/g



Sample: FULL- N2@77K- ADS/DES  
 Operator:  
 Submitter:  
 File: D:\OneDrive - Zachodniopomorski Uniwersytet Technologiczny w  
 Szczecinie\Doktorat\B...\BicSi\_FULL.SMP

Started:	18.11.2022 14:39:39	Analysis adsorptive:	N2
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Sample mass:	0,8902 g	Ambient free space:	28,0000 cm <sup>3</sup> Entered
Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

## Sample Information

Method: FULL- N2@77K- ADS/DES  
 Sample: FULL- N2@77K- ADS/DES  
 Operator:  
 Submitter:  
 Mass type: Entered  
 Sample mass: 0,8902 g  
 Density: 1,000 g/cm<sup>3</sup>  
 Type of data: Automatically collected  
 Instrument type: 2460  
 Original instrument type: 2460  
 Comments:

## Sample Tube

Sample tube: W1  
 Ambient free space: 1,0000 cm<sup>3</sup>  
 Analysis free space: 1,0000 cm<sup>3</sup>  
 Non-ideality factor: 0,0000620  
 Use isothermal jacket: Yes  
 Use filler rod: No  
 Vacuum seal type: None

## Degas Conditions

Degas conditions: FULL- N2@77K- ADS/DES

Smart VacPrep evacuation  
 Backfill sample tube: Automatic  
 Evacuation rate: 0,27 kPa/s  
 Unrest. evacuation from: 0,27 kPa  
 Vacuum level: 7e-02 kPa  
 Evacuation time: 60 min  
 Temperature ramp rate: 10,0 K/min  
 Target temperature: 363 K  
 Hold pressure: 13,3 kPa

### Heating Phase

Sample prep: Stage	Temperature (K)	Ramp Rate (K/min)	Time (min)
1	523	10,0	720

## Analysis Conditions

Sample: FULL- N2@77K- ADS/DES

Operator:

Submitter:

File: D:\OneDrive - Zachodniopomorski Uniwersytet Technologiczny w  
Szczecinie\Doktorat\B...\BicSi\_FULL.SMP

Started:	18.11.2022 14:39:39	Analysis adsorptive:	N2
Completed:	21.11.2022 18:42:54	Analysis bath temp.:	77,300 K
Report time:	22.11.2022 14:25:20	Thermal correction:	Yes
Sample mass:	0,8902 g	Ambient free space:	28,0000 cm <sup>3</sup> Entered
Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

Analysis conditions: FULL- N2@77K- ADS/DES  
 Isotherm collection: Target Pressure  
 Absolute pressure dosing: No

Pressure Table		
Starting Pressure (p/p°)	Pressure Increment (p/p°)	Ending Pressure (p/p°)
0,000000000		0,010000000
0,010000000	0,050000000	0,995000000
0,995000000	0,100000000	0,150000000

## Preparation

Fast evacuation: No  
 Evacuation rate: 0,27 kPa/s  
 Unrestricted evacuation from: 0,27 kPa  
 Vacuum setpoint: 1,3 Pa  
 Evacuation time: 4,00 h

Leak test: No  
 Use TranSeal: No

## Free Space

Entered

Ambient free space: 28,0000 cm<sup>3</sup>  
 Analysis free space: 83,0000 cm<sup>3</sup>

## p° and Temperature

p° type: Measured in Psat tube for each point  
 Temperature type: Entered  
 Temperature: 77,300 K

## Dosing

Use first pressure fixed dose: No  
 Use maximum volume increment: No  
 Target tolerance: 5.0% or 0,6666 kPa  
 Low pressure dosing: Yes  
 Dose amount: 0,02739 mmol/g  
 Minimum equilibration delay: 0,50 h  
 Maximum equilibration delay: 2,00 h  
 Maximum number of decants: 6

Sample: FULL- N2@77K- ADS/DES

Operator:

Submitter:

File: D:\OneDrive - Zachodniopomorski Uniwersytet Technologiczny w  
Szczecinie\Doktorat\B...\BicSi\_FULL.SMP

Started:	18.11.2022 14:39:39	Analysis adsorptive:	N2
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Report time:	22.11.2022 14:25:20	Thermal correction:	Yes
Sample mass:	0,8902 g	Ambient free space:	28,0000 cm <sup>3</sup> Entered
Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

	Equilibration Relative Pressure (p/p°)	Equilibration Interval (s)
1	1,000000000	30

Minimum equilibration delay at p/p° &gt;= 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 @ 77.35 K (N2)
Non-condensing adsorptive:	No
Maximum manifold pressure:	123,323 kPa
Therm. tran. hard-sphere diameter:	3,8600 Å
Molecular cross-sectional area:	0,162 nm <sup>2</sup>
Adsorbate molecular weight:	28,01
Thermal conductivity:	1,00
Non-ideality factor:	0,0000620
Density conversion factor:	0,0015468
Dosing method:	Normal

## Psat vs. Temperature Table

	Saturation Pressure (kPa)	Temperature (K)
1	80,0192	75,40
2	84,5947	75,85
3	89,9104	76,35
4	96,0481	76,90
5	98,9411	77,15
6	101,3028	77,35
7	103,7071	77,55
8	107,3945	77,85
9	113,7597	78,35
10	120,4064	78,85

## Report Options

Inside diameter of sample tube: 9,53 mm

Sample: FULL- N2@77K- ADS/DES

Operator:

Submitter:

File: D:\OneDrive - Zachodniopomorski Uniwersytet Technologiczny w  
Szczecinie\Doktorat\B...\BicSi\_FULL.SMP

Started:	18.11.2022 14:39:39	Analysis adsorptive:	N2
Completed:	21.11.2022 18:42:54	Analysis bath temp.:	77,300 K
Report time:	22.11.2022 14:25:20	Thermal correction:	Yes
Sample mass:	0,8902 g	Ambient free space:	28,0000 cm <sup>3</sup> Entered
Analysis free space:	83,0000 cm <sup>3</sup>	Equilibration interval:	30 s
Low pressure dose:	0,02739 mmol/g	Sample density:	1,000 g/cm <sup>3</sup>
Automatic degas:	No		

## Sample Log

Date	Time	Log Message
18.11.2022	14:39:39	Starting a sample analysis for C:\ASAP 2460\data\2022\Kędzierski\Si...\BicSi_FULL.SMP on port 2.
18.11.2022	19:45:20	Low pressure data collection started
21.11.2022	11:17:39	Standard data collection started.
21.11.2022	18:19:28	Termination started.
21.11.2022	18:42:54	Finished a sample analysis for C:\ASAP 2460\data\2022\Kędzierski\Si...\BicSi_FULL.SMP on port 2.