Fuel Cell Data Sheet

Contents

In this lab, Students got a hands on experience with fuel cells and got a more detailed view to how fuel cells work. The purpose of the lab was to determine how much energy is lost when storing it in a fuel cell. On both efficiency data sheets, students ran tests and recorded the volume of Hydrogen, time, Voltage, and current. Students then were expected to calculate the power, electrical energy in, moles of hydrogen, chemical energy out, and efficiency of each run using equations taught to them in ENGR 115. The plot sheets contain a plot of efficiency over time for both our electrolyzer and fuel cell.

Felix Chavez
Lab 14
12/2/2016

Input Parameters	
Tempature (K)	292.2
Pressure (atm)	1
Gas Constant R [L*atm/mol*K]	0.0821
Energy of H_2 (KJ/mol)	237

Final Efficiencies:	
Run 1	10.42730419
Run 2	10.62619725
Run 3	11.05246653
Average	10.70198933

Run 1 Data:			
Time (seconds)	H_2 Volume (mL)	Voltage (v)	Current (A)
0	0	11.92	0.59
30	2	11.92	0.61
60	5	11.91	0.63
90	8	11.91	0.64
120	10	11.9	0.65
150	12	11.89	0.67
180	15	11.6	0.66
210	17	11.31	0.65
240	19	11.09	0.66
270	21	11.14	0.66
300	23	10.96	0.66
330	26	10.84	0.66

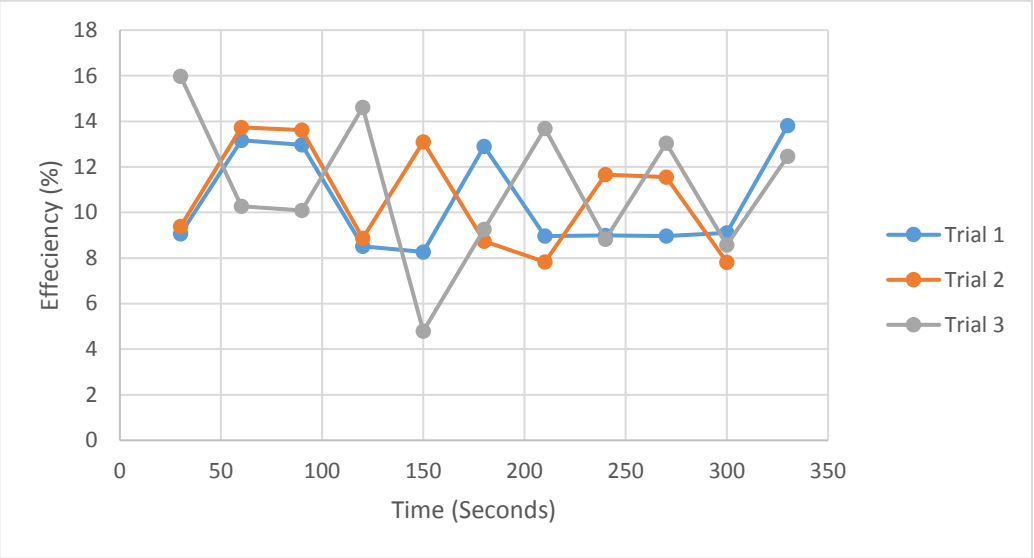
Run 1 Calculations:				
Power (W)	Electrical Energy in (J)	Moles H_2 (mols)	Chemical Energy out (kJ)	Efficiency (%)
--	--	--	--	--
7.2712	218.136	8.33694E-05	19.75854557	9.057902213
7.5033	225.099	0.000125054	29.63781836	13.16657042
7.6224	228.672	0.000125054	29.63781836	12.96084276
7.735	232.05	8.33694E-05	19.75854557	8.514779388
7.9663	238.989	8.33694E-05	19.75854557	8.267554394
7.656	229.68	0.000125054	29.63781836	12.90396132
7.3515	220.545	8.33694E-05	19.75854557	8.958963282
7.3194	219.582	8.33694E-05	19.75854557	8.99825376
7.3524	220.572	8.33694E-05	19.75854557	8.957866624
7.2336	217.008	8.33694E-05	19.75854557	9.104984872
7.1544	214.632	0.000125054	29.63781836	13.80866709

Run 2 Data:			
Time (seconds)	H_2 Volume (mL)	Voltage (V)	Current (A)
0	26	10.84	0.66
30	28	10.8	0.65
60	31	10.9	0.66
90	34	10.83	0.67
120	36	10.92	0.68
150	39	10.94	0.69
180	41	10.93	0.69
210	43	11.37	0.74
240	46	11.3	0.75
270	49	11.26	0.76
300	51	11.24	0.75

Run 2 Calculations:				
Power (W)	Electrical Energy in (J)	Moles H_2 (mols)	Chemical Energy out (kJ)	Efficiency (%)
--	--	--	--	--
7.02	210.6	8.33694E-05	19.75854557	9.382025437
7.194	215.82	0.000125054	29.63781836	13.73265608
7.2561	217.683	0.000125054	29.63781836	13.61512767
7.4256	222.768	8.33694E-05	19.75854557	8.869561863
7.5486	226.458	0.000125054	29.63781836	13.08755635
7.5417	226.251	8.33694E-05	19.75854557	8.733020217
8.4138	252.414	8.33694E-05	19.75854557	7.827832676
8.475	254.25	0.000125054	29.63781836	11.65695904
8.5576	256.728	0.000125054	29.63781836	11.54444328
8.43	252.9	8.33694E-05	19.75854557	7.812789866

Run 3 Data:			
Time (seconds)	H_2 Volume (mL)	Voltage (V)	Current (A)
0	0	11.89	0.49
30	3	11.89	0.52
60	5	11.88	0.54
90	7	11.87	0.55
120	10	11.86	0.57
150	11	11.85	0.58
180	13	11.85	0.6
210	16	11.84	0.61
240	18	11.84	0.63
270	21	11.84	0.64
300	23	11.83	0.65
330	26	11.83	0.67

Run 3 Calculations:				
Power (W)	Electrical Energy in (J)	Moles H_2 (mols)	Chemical Energy out (kJ)	Efficiency (%)
--	--	--	--	--
6.1828	185.484	0.000125054	29.63781836	15.97863878
6.4152	192.456	8.33694E-05	19.75854557	10.26652615
6.5285	195.855	8.33694E-05	19.75854557	10.08835392
6.7602	202.806	0.000125054	29.63781836	14.61387649
6.873	206.19	4.16847E-05	9.879272785	4.791344287
7.11	213.3	8.33694E-05	19.75854557	9.263265622
7.2224	216.672	0.000125054	29.63781836	13.67865638
7.4592	223.776	8.33694E-05	19.75854557	8.829608882
7.5776	227.328	0.000125054	29.63781836	13.03746936
7.6895	230.685	8.33694E-05	19.75854557	8.565162698
7.9261	237.783	0.000125054	29.63781836	12.4642293


18
16
14
12
10
8
6
4
2
0
Effeciency (%)
0
50
100
150
200
250
300
350
Time (Seconds)
Trial 1
Trial 2
Trial 3

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Input Parameters	
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Energy of H_2 (KJ/mol)	237

Final Efficiencies:	
Run 1	27.17069085
Run 2	48.68779418
Average	37.92924251

Run 1 Data:

Time (seconds)	H_2 Volume (mL)	Voltage (v)	Current (A)
0	44	0.57	0.24
20	43	0.57	0.24
40	42.5	0.57	0.24
60	42	0.57	0.24
80	41	0.5	0.23
100	40	0.49	0.22
120	39.5	0.47	0.22
140	39	0.47	0.21
160	38	0.45	0.2
180	37	0.43	0.2
200	36.5	0.39	0.18
220	36	0.38	0.17
240	35.5	0.33	0.16
260	35	0.29	0.15
280	34	0.28	0.13
300	33	0.23	0.12

Run 1 Calculations:

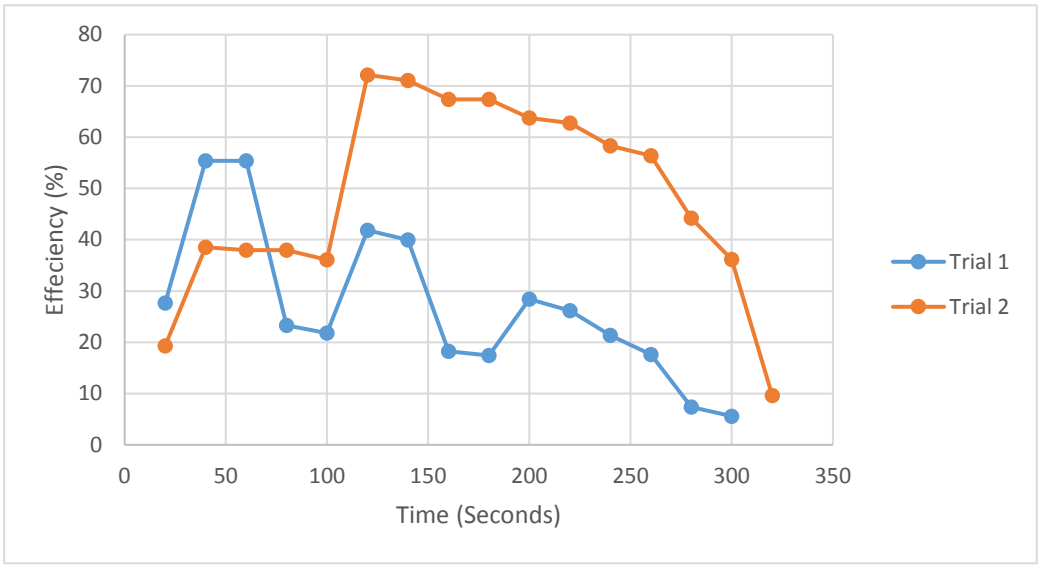
Power (W)	Electrical Energy in (J)	Moles H_2 (mols)	Chemical Energy out (kJ)	Efficiency (%)
--	--	--	--	--
0.1368	2.736	4.16847E-05	9.879272785	27.69434613
0.1368	2.736	2.08423E-05	4.939636393	55.38869225
0.1368	2.736	2.08423E-05	4.939636393	55.38869225
0.115	2.3	4.16847E-05	9.879272785	23.28106582
0.1078	2.156	4.16847E-05	9.879272785	21.82346866
0.1034	2.068	2.08423E-05	4.939636393	41.86542967
0.0987	1.974	2.08423E-05	4.939636393	39.96245559
0.09	1.8	4.16847E-05	9.879272785	18.21996456
0.086	1.72	4.16847E-05	9.879272785	17.41018835
0.0702	1.404	2.08423E-05	4.939636393	28.42314471
0.0646	1.292	2.08423E-05	4.939636393	26.15577134
0.0528	1.056	2.08423E-05	4.939636393	21.37809175
0.0435	0.87	2.08423E-05	4.939636393	17.61263241
0.0364	0.728	4.16847E-05	9.879272785	7.368963443
0.0276	0.552	4.16847E-05	9.879272785	5.587455797

Run 2 Data:

Time (seconds)	H_2 Volume (mL)	Voltage (V)	Current (A)
0	20	0.7	0.28
20	18	0.68	0.28
40	17	0.68	0.28
60	16	0.67	0.28
80	15	0.67	0.28
100	14	0.66	0.27
120	13.5	0.66	0.27
140	13	0.65	0.27
160	12.5	0.64	0.26
180	12	0.64	0.26
200	11.5	0.63	0.25
220	11	0.62	0.25
240	10.5	0.6	0.24
260	10	0.58	0.24
280	9.5	0.52	0.21
300	9	0.47	0.19
320	8	0.34	0.14

Run 2 Calculations:

Power (W)	Electrical Energy in (J)	Moles H_2 (mols)	Chemical Energy out (kJ)	Efficiency (%)
--	--	--	--	--
0.1904	3.808	8.33694E-05	19.75854557	19.27267362
0.1904	3.808	4.16847E-05	9.879272785	38.54534724
0.1876	3.752	4.16847E-05	9.879272785	37.9785039
0.1876	3.752	4.16847E-05	9.879272785	37.9785039
0.1782	3.564	4.16847E-05	9.879272785	36.07552982
0.1782	3.564	2.08423E-05	4.939636393	72.15105965
0.1755	3.51	2.08423E-05	4.939636393	71.05786177
0.1664	3.328	2.08423E-05	4.939636393	67.37338005
0.1664	3.328	2.08423E-05	4.939636393	67.37338005
0.1575	3.15	2.08423E-05	4.939636393	63.76987595
0.155	3.1	2.08423E-05	4.939636393	62.7576557
0.144	2.88	2.08423E-05	4.939636393	58.30388658
0.1392	2.784	2.08423E-05	4.939636393	56.3604237
0.1092	2.184	2.08423E-05	4.939636393	44.21378066
0.0893	1.786	2.08423E-05	4.939636393	36.15650744
0.0476	0.952	4.16847E-05	9.879272785	9.63633681


80
70
60
50
40
30
20
10
0
Effeciency (%)
0
50
100
150
200
250
300
350
Time (Seconds)
Trial 1
Trial 2