PEM Fuel Cells

1. Fuel Cell Thermodynamics (Nernst Equation)

1.1 Temperature Dependance of Quiescent Voltage

Cathode Gas	Air
p_ges [bar]	1
U_00 [mV]	1229
R	8,314
z	2
F	96487

Wichtige Dampfdruckwerte von H2O (in bar):	
30 °C	0,042452
40 °C	0,073813
50 °C	0,123448
60 °C	0,19933

T [°C]	T [K]	U_Exp [mV]	p_H2 [bar]	p_O2 [bar]	U_Theory [mV]
30	303	921	0,957548	0,1915096	1217,645518
40	313	914	0,926187	0,1852374	1216,597206
50	323	912	0,876552	0,1753104	1215,05121
60	333	910,5	0,80067	0,160134	1212,670764

1.2 Pressure Dependance of Quiescent Voltage

	40 °C / Air		40 °C / O_2		60 °C / Air		60 °C / O_2	
p [bar]	**U_Exp [mV]**	**U_Theory [mV]**	**U_Exp [mV]**	**U_Theory [mV]**	**U_Exp [mV]**	**U_Theory [mV]**	**U_Exp [mV]**	**U_Theory [mV]**
1	914	1216,597206	956	1227,448957	910,5	1212,670764	970	1224,215917
2	934,5	1231,408374	981	1242,260125	928	1230,112155	1000	1241,657307
3	940	1239,866751	986,5	1250,718501	935	1239,617633	1004	1251,162786

2. Fuel Cell Kinetics (Current-Voltage-Curves)

	40 °C / Ox. / 3 bar	60 °C / Ox. / 1 bar	60 °C / Ox. 3 bar			60 °C / Air / 3 bar		
U [mV]	**I [mA]**	**I [mA]**	**I [mA]**	**P [mW]**	**etha [%]**	**I [mA]**	**P [mW]**	**etha [%]**
900	0	0	2	1,8	62,72063824	0	0	63,30478559
800	24,5	20	57	45,6	55,75167844	18	14,4	56,27092052
700	75	89	135	94,5	48,78271863	75	52,5	49,23705546
600	135	181	224	134,4	41,81375883	142	85,2	42,20319039
500	203	280	320	160	34,84479902	214	107	35,16932533
400	279	385	424,5	169,8	27,87583922	281	112,4	28,13546026
300	367	502	541	162,3	20,90687941	340	102	21,1015952
200	461	628	671	134,2	13,93791961	371	74,2	14,06773013
100	561	770	810	81	6,968959805	386	38,6	7,033865066

Hinweis: Berechnung der Wirkungsgrade:

Thermisch: Delta_G / Delta_H = U_00 * z * F / 272000

Spannung: U_gemessen / U_0(T)