

NAME	DH-20	Start Date:	20.08.21
Description	NH ₃ at 650 °C, 10 bar		

Tube:	N/A		
Electrode:	Ni-BCZY-Protonic		
Length:	5	cm	
Area:	14.45132621	cm ²	

Reaction Conditions				
Temperature:	650			
Pressure:	10			
		Flow mL/min	Pressure bar	Concentration %
Feed:	NH ₃	13.2	7.3	72.5
	H ₂ O	5.0	2.7	27.5
	He	0.0	0.0	0.0
	Total	18.1	10.0	100.0
		Flow mL/min	Pressure bar	Concentration %
Sweep:	He	100.0	8.0	80.1
	H ₂ O	24.9	2.0	19.9
	Total	124.9	10.0	100.0

GC Areas									
Feed - TCD Back					Sweep - TCD Aux				
Helium	Hydrogen	Nitrogen	Ammonia	Water	Helium	Hydrogen	Nitrogen	Ammonia	Water
36613803	421618176	14341175	1853461	3346771	375057330	18429278	261805	0	49953277
42252733	378267931	17679797	2023250	4447721	372933089	49312036	252006	0	46735689
60627866	267257874	24723357	1090495	6415296	355933030	77743633	262691	0	42830156
74407313	170670351	31456583	730123	7311614	329496316	99212581	281658	0	43250587
94223386	11941376.6	41501022	123025.8	9472236	323627766.5	107069302	316580.5	0	45249765

Flow (mL/min)									
Feed					Sweep				
Helium	Hydrogen	Nitrogen	Ammonia	Water	Helium	Hydrogen	Nitrogen	Ammonia	Water
2.0	16.3	6.3	0.3	0.1	82.1	2.5	0.4	0.0	5.1
2.4	12.4	6.7	0.1	0.1	83.3	7.2	0.5	0.0	4.9
2.9	7.4	7.9	0.1	0.1	83.8	11.8	0.5	0.0	4.6
2.9	3.8	8.3	0.0	0.1	82.1	15.7	0.6	0.0	4.8
3.6	0.3	10.7	0.0	0.1	80.6	17.2	0.6	0.0	5.0

H ₂ Balance	Current Density	H ₂ Extraction	Ammonia Conversion	H ₂ Flux
%	mA/cm ²	%	%	mL/min·cm ²
97.64	0.00	0.00	97.91	0.18
99.24	55.36	37.20	99.13	0.51
97.37	110.72	61.88	99.59	0.83
98.04	166.07	81.30	99.78	1.08
90.70	221.43	98.48	99.96	1.17

Datapoints 1, 2, 3

NAME	DH-8	Start Date:	18.03.2021
Description	Aq. NH3 at 750 °C, 10bara		

Tube:	N/A		
Electrode:	Ni-BCZY-Protonic		
Length:	5	cm	
Area:	14.45132621	cm ²	

Reaction Conditions

Temperature:	750		
Pressure:	10		

		Flow mL/min	Pressure bar	Concentration %
Feed:	NH ₃	35.0	3.1	30.8
	H ₂ O	66.0	5.8	58.1
	He	12.6	1.1	11.1
	Total	113.6	10.0	100.0

		Flow mL/min	Pressure bar	Concentration %
Sweep:	N ₂	105.5	8.1	80.8
	H ₂ O	25.0	1.9	19.2
	Total	130.5	10.0	100.0

Datapoint 4

NAME	DH-8	Start Date:	19.03.2021
Description	Aq. NH3 at 750 °C, 10bara		

Tube:	N/A		
Electrode:	Ni-BCZY-Protonic		
Length:	5	cm	
Area:	14.45132621	cm ²	

Reaction Conditions

Temperature:	750		
Pressure:	10		

		Flow mL/min	Pressure bar	Concentration %
Feed:	NH ₃	71.0	3.4	34.1
	H ₂ O	124.4	6.0	59.8
	He	12.6	0.6	6.1
	Total	208.0	10.0	100.0

		Flow mL/min	Pressure bar	Concentration %
Sweep:	N ₂	105.5	8.1	80.8
	H ₂ O	25.0	1.9	19.2
	Total	130.5	10.0	100.0

GC Areas									
Feed - TCD Back					Sweep - TCD Aux				
Helium	Hydrogen	Nitrogen	Ammonia	Water	Helium	Hydrogen	Nitrogen	Ammonia	Water
30338948	241827563	10678460	1854523	41577014	1807041	13780577	53109860	0	45459439
36147734	151722815	12035288	1590943	50898609	1752358	124811789	45900192	0	38902396
47677627	16587835	12237826	95576	66727620	1717783	196908320	41236018	0	35261128
26405150	121318047	15304945	1570637	56838249	981085	328057232	33127976	0	28293344

Flow (mL/min)									
Feed					Sweep				
Helium	Hydrogen	Nitrogen	Ammonia	Water	Helium	Hydrogen	Nitrogen	Ammonia	Water
11.5	36.6	20.2	0.3	38.0	0.5	2.0	100.9	0.0	32.1
9.0	22.7	23.5	0.3	31.6	0.5	23.7	101.4	0.0	31.9
10.5	2.1	18.5	0.0	37.9	0.6	42.7	101.9	0.0	32.7
13.1	5.3	42.7	0.2	69.3	0.4	94.5	104.3	0.0	32.9

H ₂ Balance	Current Density	H ₂ Extraction	Ammonia Conversion	H ₂ Flux
%	mA/cm ²	%	%	mL/min·cm ²
74.59	0	0	98.36	0.00
89.27	228	54.31	98.89	1.54
85.44	415	95.03	99.93	2.84
95.31	1038	76.69	99.4	6.29

NAME M-PMR-1-1 Start Date: 01.12.2020
Description PMR at 750 °C, 10 bar

Tube: N/A
Electrode: Ni-BCZY-Protonic
Length: 5 cm
Area: 14.45132621 cm²

Reaction Conditions				
Temperature:		750		
Pressure:		10		
Feed:		Flow mL/min	Pressure bar	Concentration %
	CH4	21.9	2.3	23.0
	H2	14.0	1.5	15.0
	H2O	57.0	6.0	61.0
	He	1.1	0.2	1.0
	Total	94.0	10.0	100.0
Sweep:		Flow mL/min	Pressure bar	Concentration %
	N2	100.0	8.0	80.1
	H ₂ O	24.9	2.0	19.9
	Total	124.9	10.0	100.0

GC Areas						
Feed - TCD Back				Sweep - TCD Aux		
Helium	Hydrogen	CO2	Methane	CO	Helium	Hydrogen
4577381	458221100	7157568	25511850	7794302	187661	20175172
5650769	419568734	11372025	19982767	10510788	178858	178297880
7112369	361546941	18300018	14278683	13224316	200954	277716450
9639485	263130854	32988199	7351567	14844466	198965	366798887
11808122	183983287	48438791	4010956	13276335	197825	395191378
13947593	107703949	65818936	1488178	9826934.5	199698.5	413235436

Flow (mL/min)				
Feed				Sweep
Hydrogen	CO2	Methane	CO	Hydrogen
61.6	6.6	6.4	6.5	2.5
46.9	8.5	4.1	7.1	28.9
31.8	10.8	2.4	7.0	54.4
17.2	14.4	0.9	5.8	79.5
9.8	17.2	0.4	4.3	91.2
4.9	19.8	0.1	2.7	99.5

C Balance	Current Density	H ₂ Extraction	Conversion	H ₂ Flux
%	mA/cm ²	%	%	mL/min·cm ²
111.00	0.00	0	68.52	0.03
111.00	254.00	38.09	78.9	1.71
108.00	509.00	63.1	88.35	3.35
103.00	764.00	82.38	95.77	5.03
100.00	891.00	90.26	98.18	5.76
97.00	1019.00	95.33	99.45	6.31

NAME B-PMR-2-4 **Start Date:** 12.03.2021
Description Bio-PMR at 750 °C, 10 bar

Tube: N/A
Electrode: Ni-BCZY-Protonic
Length: 5 cm
Area: 14.45132621 cm²

Reaction Conditions				
Temperature:	750			
Pressure:	10			
		Flow	Pressure	Concentration
		mL/min	bar	%
Feed:	CH4	19.5	1.9	18.9
	H2	12.7	1.2	12.3
	H2O	53.1	5.2	51.7
	CO2	16.6	1.6	16.1
	He	1.0	0.1	1.0
	Total	102.9	10.0	100.0
		Flow	Pressure	Concentration
		mL/min	bar	%
Sweep:	N2	100.0	8.0	80.1
	H ₂ O	24.9	2.0	19.9
	Total	124.9	10.0	100.0

GC Areas							
Feed - TCD Back					Sweep - TCD Aux		
Helium	Hydrogen	CO ₂	Methane	CO	Helium	Hydrogen	
3991585	348869084	6385200	22680760	10906658	184595	26201869	
4525251	311590510	8717584	16687577	12166464	186789	169032411	
5351564	253745442	12134559	10904967	13361663	167241	282761014	
6578832	169805741	18060226	3921890	12898443	158622	358793859	
7786236	82999153	25393227	892715	8496034	151745	396367740	
8551447	32013091	30713222	111790	3715296	152267	416157076	
8748317	18684830	32201109		0	2809212	155565	421616170
8804928	14328926	32716330		0	2231718	155696	422944882

Flow (mL/min)					
Feed				Sweep	
Hydrogen	CO ₂	Methane	CO	Hydrogen	CO
49.3	11.1	11.0	17.1	3.3	0.9
38.8	13.4	7.1	16.8	25.7	3.7
26.7	15.7	3.9	15.6	25.7	5.2
14.5	19.0	1.2	12.3	76.4	5.9
6.0	22.6	0.2	6.8	91.9	6.2
2.1	24.9	0.0	2.7	101.0	6.2
1.2	25.5	0.0	2.0	103.6	6.5
0.9	25.8	0.0	1.6	104.3	6.4

C Balance	urrent Densit	H ₂ Extraction	Conversion	H ₂ Flux
%	mA/cm ²	%	%	mL/min·cm ²
90	0	6.2	72	0.09
88	277	39.73	80.87	1.80
89	554	65.98	88.83	3.49
94	830	84.01	96.45	5.23
101	1024	93.83	99.25	6.51
107	1107	97.95	100	7.02
106	1142	98.85	100	7.17
107	1176	99.13	100	7.21