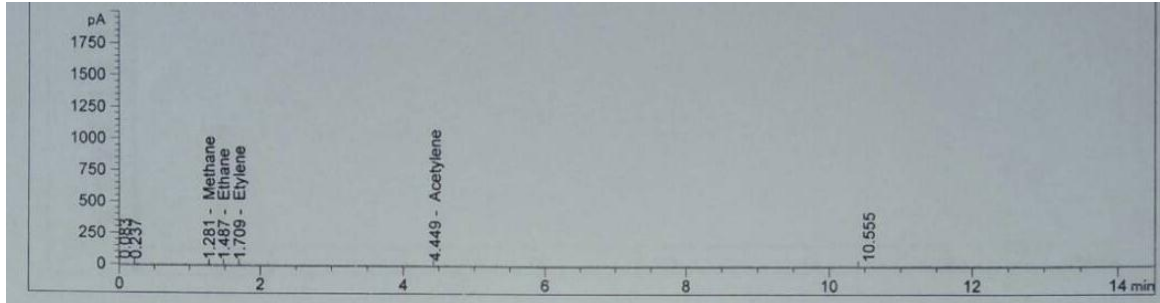


Supplementary file

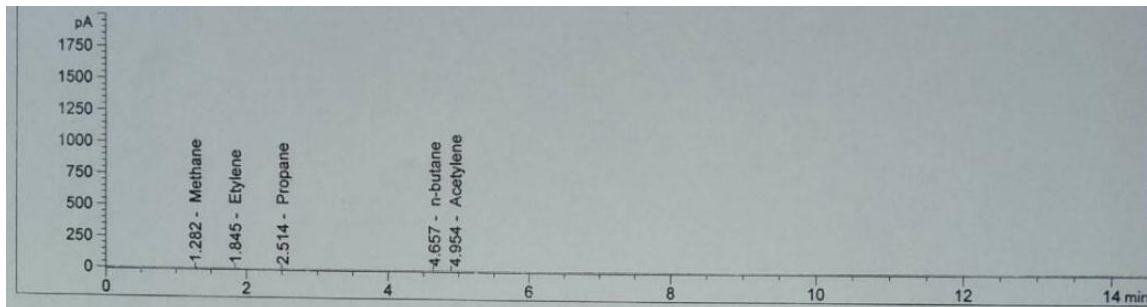
GC-FID Analysis of Output reactor

Stainless Steel 304 using CVD methods



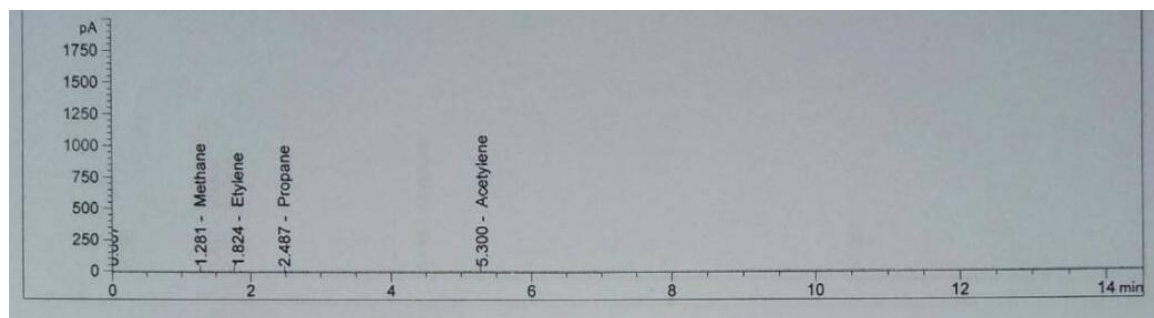
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [%]	Grp	Name
1.281	BB	9.74357e-1	6.77691e-3	6.60313e-3		Methane
1.487	BB	1.50493e-1	3.89409e-3	5.86034e-4		Ethane
1.709	BB	2.07705e-1	3.72858e-3	7.74443e-4		Etylene
2.492		-	-	-		Propane
3.882		-	-	-		Propylene
4.449	BB	1.55778	3.60633e-3	5.61785e-3		Acetylene
4.631		-	-	-	27	iso-butane
4.702		-	-	-	26	n-butane
6.320		-	-	-	29	trans-2-butene
6.396		-	-	-	32	1-butene
6.778		-	-	-		isobutilen
6.786		-	-	-		cis-2-butene
6.791		-	-	-	36	neopentane
7.325		-	-	-	35	i-Pentane
7.841		-	-	-	34	n-Pentane
8.583		-	-	-		1,3 Butadiene
11.573		-	-	-		Hexane
Totals :				1.35815e-2		

Figure 29. GC-FID of Stainless Steel 304 Foil within 20 minutes using CVD



RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [%]	Grp	Name
1.282	BB	1.99753	6.77691e-3	1.35371e-2		Methane
1.525		-	-	-		Ethane
1.845	BB	1.25279e-1	3.72858e-3	4.67114e-4		Etylene
2.514	BV	2.68664e-1	2.57220e-3	6.91059e-4		Propane
3.882		-	-	-		Propylene
4.631		-	-	-		iso-butane
4.657	BV	3.17727e-1	1.92111e-3	6.10389e-4	27	n-butane
4.954	BB	5.28444e-1	3.60633e-3	1.90574e-3	26	Acetylene
6.320		-	-	-		trans-2-butene
6.396		-	-	-		1-butene
6.778		-	-	-		isobutilen
6.786		-	-	-		cis-2-butene
6.791		-	-	-		neopentane
7.325		-	-	-		i-Pentane
7.841		-	-	-		n-Pentane
8.583		-	-	-		1,3 Butadiene
11.573		-	-	-		Hexane
Totals :				1.72114e-2		

Figure 30. GC-FID of Stainless Steel 304 plate after 20 minutes using CVD



RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [%]	Grp	Name
1.281	BV	5.85978e-1	6.77691e-3	3.97112e-3		Methane
1.525		-	-	-		Ethane
1.824	VB	1.76585e-1	3.72858e-3	6.58409e-4		Etylene
2.487	BB	2.12625e-2	2.57220e-3	5.46915e-5		Propane
3.882		-	-	-		Propylene
4.631		-	-	-		iso-butane
4.702		-	-	-		n-butane
5.300	BB	2.05024e-1	3.60633e-3	7.39385e-4		Acetylene
6.320		-	-	-		trans-2-butene
6.396		-	-	-		1-butene
6.778		-	-	-		isobutilen
6.786		-	-	-		cis-2-butene
6.791		-	-	-		neopentane
7.325		-	-	-		i-Pentane
7.841		-	-	-		n-Pentane
8.583		-	-	-		1,3 Butadiene
11.573		-	-	-		Hexane
Totals :				5.42361e-3		

Figure 31. GC-FID of Stainless Steel 304 Wiremesh after 20 minutes synthesis using CVD

Carbon Loss Calculation of Stainless Steel 304 within 20 minutes using CVD

Table 1. Input and Output data after 20 minutes using CVD

Substrates	t min	t (hr)	Input		Input flow (gr/hr)	Output			
			Flow (mL/min)	Mol (mol/h)		V bubble (mL)	t bubble (s)	Flow (mL/min)	Mol (mol/hr)
Foil	20	0.33	45	0.10968	1.31616	10	0.947	633.5797	1.5442
Plate	20	0.33	45	0.10968	1.31616	10	0.938	639.6588	1.5591
Wiremesh	20	0.33	45	0.10968	1.31616	10	0.952	630.2521	1.5361

Table 2. Composition data of reactor output gas in minutes 20

Substrates	Gas composition (y, %)					
	CH ₄	C ₂ H ₆	C ₂ H ₄	C ₃ H ₈	nC ₄ H ₁₀	C ₂ H ₂
Foil	0.00660313	0.000586034	0.000774443	-	-	0.00561785
Plate	0.00135371	-	0.00046711	0.000691059	0.000610389	0.00190574
Wiremesh	0.00397112	-	0.000658409	0.0000546915	-	0.000739385

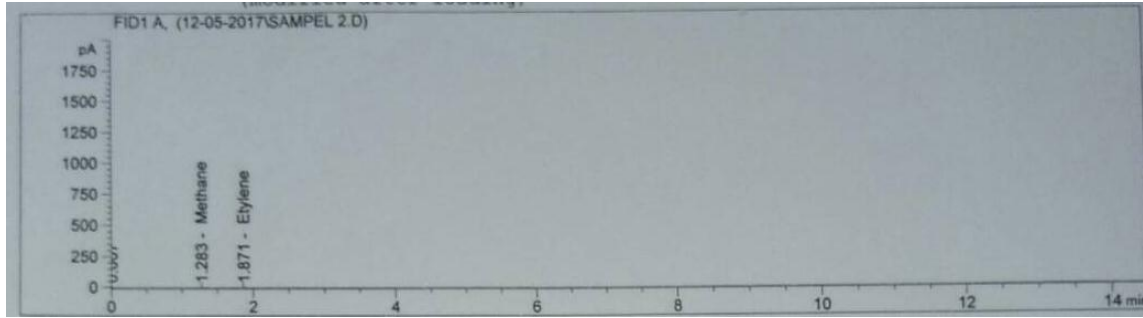
Table 3. Output flowrate and conversion after 20 minutes using CVD

Substrates	Output Flowrate (mol/hr)						Conversion (%)
	CH ₄	C ₂ H ₆	C ₂ H ₄	C ₃ H ₈	C ₄ H ₁₀	C ₂ H ₂	
Foil	0.010372	0.000921	0.001216			0.008824418	91.95438596
Plate	0.002126	0	0.000734	0.001086	0.000959	0.002993502	97.27069101
Wiremesh	0.006238	0	0.001034	0.0000859	0	0.001161413	98.94108844

Table 4. Carbon Loss calculation of Stainless Steel 304 using CVD

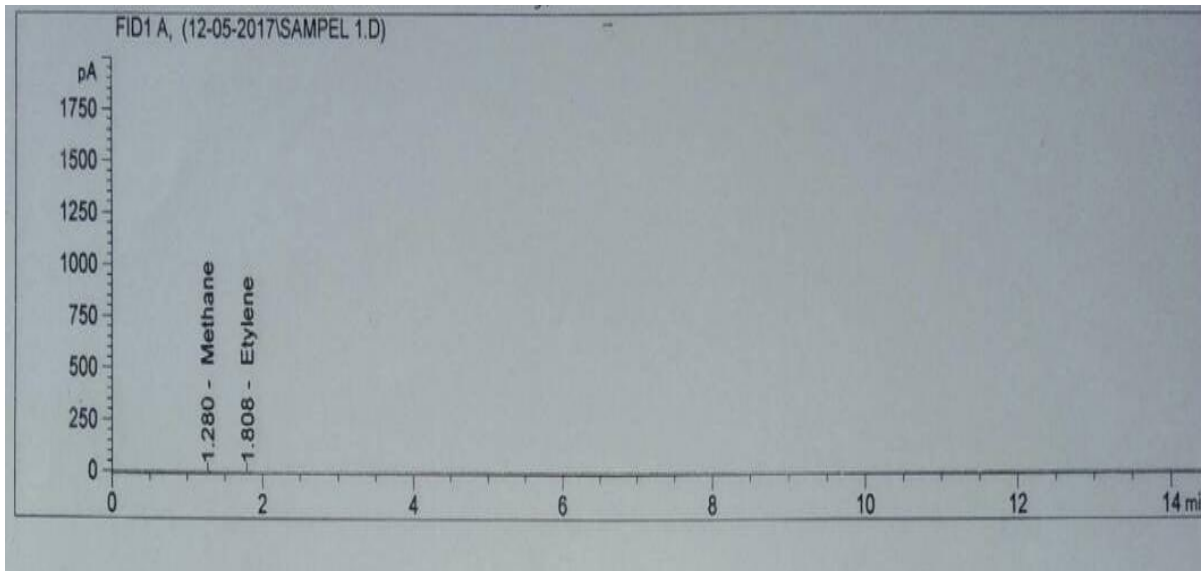
Substrates	t (hour)	Input flow (g/jam)	Output flow (g/jam)	Input accumulation	Output accumulation	Theoretical carbon (g)	Carbon result(g)	Carbon Loss (%)
Foil	0.33	1.31616	0.15011	0.21936	0.02502	0.19434	0.0006	99.69
Plate	0.33	1.31616	0.04735	0.21936	0.00789	0.21147	0.0009	99.57
Wiremesh	0.33	1.31616	0.08829	0.21936	0.20464	0.20464	0.0042	97.95

GC-FID of Stainless Steel 304 using FC-CVD



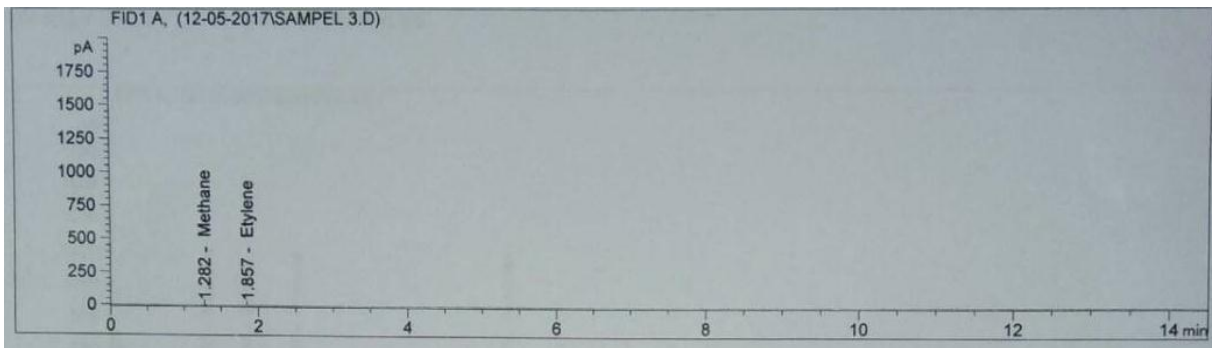
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [%]	Grp	Name
1.283	BB	4.10587e-1	6.77691e-3	2.78251e-3		Methane
1.525		-	-	-		Ethane
1.871	BB	1.50110e-1	3.72858e-3	5.59697e-4		Etylene
2.492		-	-	-		Propane
3.882		-	-	-		Propylene
4.631		-	-	-	27	iso-butane
4.657		-	-	-	26	n-butane
4.954		-	-	-		Acetylene
6.320		-	-	-	29	trans-2-butene
6.396		-	-	-	32	1-butene
6.778		-	-	-		isobutilen
6.786		-	-	-		cis-2-butene
6.791		-	-	-	36	neopentane
7.325		-	-	-	35	i-Pentane
7.841		-	-	-	34	n-Pentane
8.583		-	-	-		1,3 Butadiene
11.573		-	-	-		Hexane
Totals :				3.34221e-3		

Gambar 32. GC-FID of Stainless Steel 304 Foil after 20 minutes using FC-CVD



RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [%]	Grp	Name
1.280	BB	3.96233e-1	6.77691e-3	2.68524e-3		Methane
1.525	-	-	-	-		Ethane
1.808	BB	1.49093e-1	3.72858e-3	5.55904e-4		Etylene
2.492	-	-	-	-		Propane
3.882	-	-	-	-		Propylene
4.631	-	-	-	-	27	iso-butane
4.657	-	-	-	-	26	n-butane
4.954	-	-	-	-		Acetylene
6.320	-	-	-	-	29	trans-2-butene
6.396	-	-	-	-	32	l-butene
6.778	-	-	-	-		isobutilen
6.786	-	-	-	-		cis-2-butene
6.791	-	-	-	-	36	neopentane
7.325	-	-	-	-	35	i-Pentane
7.841	-	-	-	-	34	n-Pentane
8.583	-	-	-	-		1,3 Butadiene
11.573	-	-	-	-		Hexane
Totals :				3.24114e-3		

Figure 33. GC-FID of Stainless Steel 304 plate after 20 minutes synthesis using FC-CVD



RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [%]	Grp	Name
1.282	BB	6.65480e-1	6.77691e-3	4.50990e-3		Methane
1.525	-	-	-	-		Ethane
1.857	BV	4.91977e-2	3.72858e-3	1.83437e-4		Etylene
2.492	-	-	-	-		Propane
3.882	-	-	-	-		Propylene
4.631	-	-	-	-	27	iso-butane
4.657	-	-	-	-	26	n-butane
4.954	-	-	-	-		Acetylene
6.320	-	-	-	-	29	trans-2-butene
6.396	-	-	-	-	32	l-butene
6.778	-	-	-	-		isobutilen
6.786	-	-	-	-		cis-2-butene
6.791	-	-	-	-	36	neopentane
7.325	-	-	-	-	35	i-Pentane
7.841	-	-	-	-	34	n-Pentane
8.583	-	-	-	-		1,3 Butadiene
11.573	-	-	-	-		Hexane
Totals :				4.69334e-3		

Figure 34. GC-FID of Stainless Steel 304 Wiremesh after 20 minutes synthesis using FC-CVD

Carbon Loss Calculation of Stainless Steel 304 using FC-CVD methods

Table 5. Input and Output data of stainless steel after 20 minutes synthesis using FC-CVD

Substrates	t (min)	t (hr)	Input		Mass flowrate (gr/hr)	Output			
			Flowrate (mL/mi)	Mol (mol/h)		V bubble (mL)	t bubble (s)	Flow (mL/mi)	Mol (mol/h)
Foil	20	0.33	45	0.10968	1.31616	10	0.938	639.6588	1.5591
Plate	20	0.33	45	0.10968	1.31616	10	0.947	633.5797	1.5442
Wiremesh	20	0.33	45	0.10968	1.31616	10	0.952	630.2521	1.5361

Table 6. Composition of output reactor gas in minute 20

Substrates	Gas composition (y, %)	
	CH ₄	C ₂ H ₄
Foil	0.0027825	0.00055697
Plate	0.0026852	0.000555904
Wiremesh	0.0045099	0.000183844

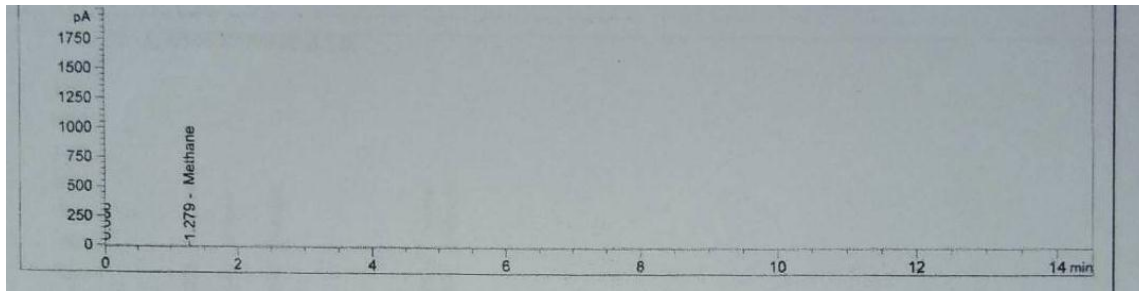
Table 7. Output flowrate and conversion after 20 minutes synthesis using FC-CVD

Substrates	Output flowrate (mol/hr)		Conversion (%)
	CH ₄	C ₂ H ₄	C ₂ H ₂
Foil	0.004297	0.00086	100
Plate	0.004147	0.000858	100
Wiremesh	0.006964	0.000284	100

Table 8. Carbon Loss calculation of Stainless Steel 304 using FC-CVD

Substrates	t (hr)	Input flowrate (gr/hr)	Output flowrate (gr/hr)	Input accumulation	Output accumulation	Theoretical carbon (gr)	Carbon result (gr)	Carbon Loss (%)
Foil	0.33	1.31616	0.06188	0.21936	0.01031	0.20905	0.0573	72.58973966
Plate	0.33	1.31616	0.06006	0.21936	0.01001	0.20935	0.0701	66.51534233
Wiremesh	0.33	1.31616	0.08698	0.21936	0.01450	0.20486	0.1246	39.178911

GC-FID of Stainless Steel 316 using acetylene as carbon source within 60 minutes



RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [%]	Grp	Name
1.279	BV	1.19394e-1	6.77691e-3	8.09122e-4		Methane
1.525	-	-	-	-		Ethane
1.834	-	-	-	-		Etylene
2.492	-	-	-	-		Propane
3.882	-	-	-	-		Propylene
4.631	-	-	-	-		
4.657	-	-	-	-	27	iso-butane
4.954	-	-	-	-	26	n-butane
6.320	-	-	-	-		Acetylene
6.396	-	-	-	-	29	trans-2-butene
6.778	-	-	-	-	32	1-butene
6.786	-	-	-	-		isobutilen
6.791	-	-	-	-		cis-2-butene
7.325	-	-	-	-	36	neopentane
7.841	-	-	-	-	35	i-Pentane
8.583	-	-	-	-	34	n-Pentane
11.573	-	-	-	-		1,3 Butadiene
						Hexane
Totals :				8.09122e-4		

Figure 35. GC-FID of Stainless Steel 316 using acetylene within 60 menit

Carbon Loss Calculation of Stainless Steel 316 using acetylene as carbon source

Table 9. Input and Output data of Stainless Steel 316 using acetylene within 60 minutes

Substrate	t (min)	t (hr)	Input		Mass flowrate (gr/hr)	Output			
			Flowrate(mL/mi)	Mol (mol/h)		V bubble (mL)	t bubble (s)	Laju alir (mL/mi)	Mol (mol/h)
Stainless steel 316	60	1	45	0.10968	1.31616	10	0.951	630.91482 65	1.53774 7728

Table 10. Composition gas of out put reactor in minutes 60

Substrates	Gas composition (y, %)
	CH ₄
Stainless Steel 316 (plate)	0.000809122

Table 11. Output flowrate and conversion of Stainless Steel 316 using acetylene within 60 menit

Substrat	Output flowrate (mol/hr)	Conversion(%)
	CH ₄	C ₂ H ₂
Stainless steel 316	0.001271	100

Table 12. Carbon Loss Calculation of Stainless Steel 316 using acetylene within 60 minutes

Substrates	t (hr)	Input flowrate (gr/hr)	Output flowrate (gr/hr)	Input accumulation	Output accumulation	Theoretical carbon (gr)	Carbon result (gr)	Carbon Loss (%)
Stainless steel 316	1	1.31616	.01525	0.65808	0.00763	0.65045	0.6325	2.76