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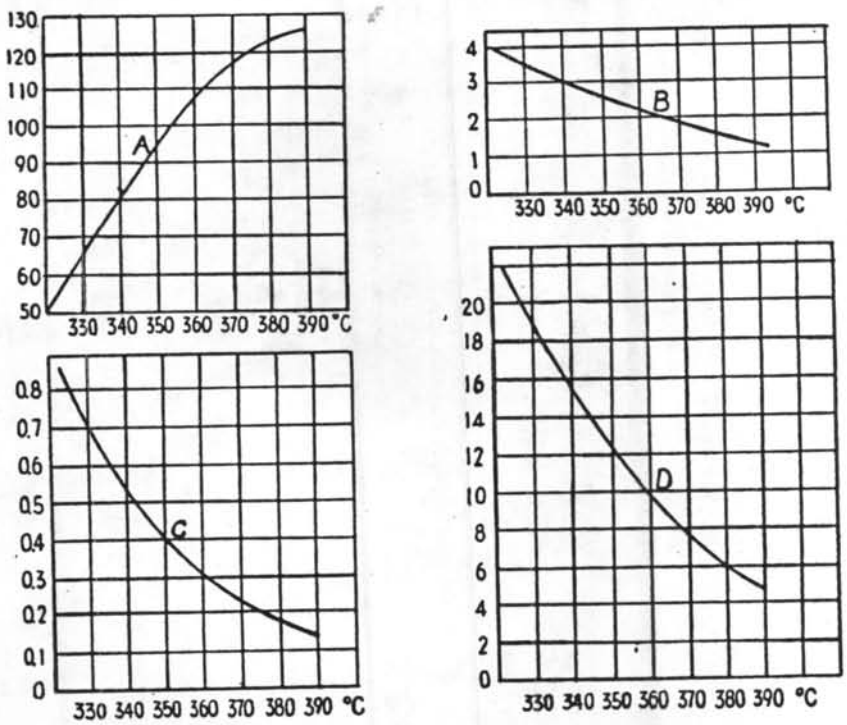
APPENDICES

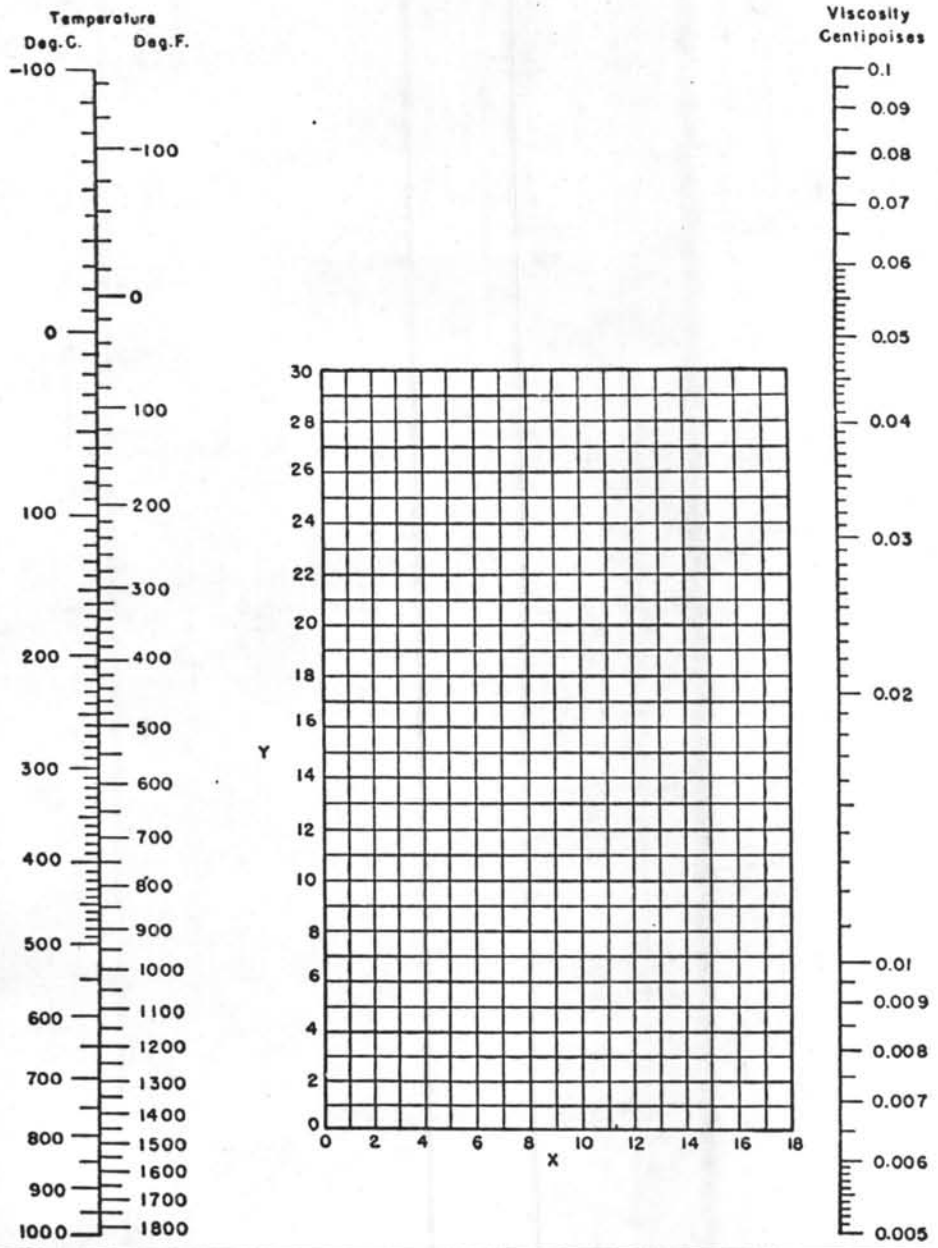
APPENDIX A

DEPENDENCE ON TEMPERATURE OF THE CONSTANTS A,B,C,D ($ZnO-Cr_2O_3$ CATALYST)



APPENDIX B

VISCOSITIES OF GASES AT 1 Atm.



Coordinates for use

No.	Gas	X	Y	No.	Gas	X	Y	No.	Gas	X	Y	No.	Gas	X	Y
1	Acetic acid	7.7	14.3	15	Chloroform	8.9	15.7	29	Freon-113	11.3	14.0	43	Nitric oxide	10.9	20.5
2	Acetone	8.9	13.0	16	Cyanogen	9.2	15.2	30	Helium	10.9	20.5	44	Nitrogen	10.6	20.0
3	Acetylene	9.8	14.9	17	Cyclohexane	9.2	12.0	31	Hexane	8.6	11.8	45	Nitrosyl chloride	8.0	17.6
4	Air	11.0	20.0	18	Ethane	9.1	14.5	32	Hydrogen	11.2	12.4	46	Nitrous oxide	8.8	19.0
5	Ammonia	8.4	16.0	19	Ethyl acetate	8.5	13.2	33	$3H_2 + 1N_2$	11.2	17.2	47	Oxygen	11.0	21.3
6	Argon	10.5	22.4	20	Ethyl alcohol	9.2	14.2	34	Hydrogen bromide	8.8	20.9	48	Pentane	7.0	12.8
7	Benzene	8.5	13.2	21	Ethyl chloride	8.5	15.6	35	Hydrogen chloride	8.8	18.7	49	Propane	9.7	12.9
8	Bromine	8.9	19.2	22	Ethyl ether	8.9	13.0	36	Hydrogen cyanide	9.8	14.9	50	Propyl alcohol	8.4	13.4
9	Butene	9.2	13.7	23	Ethylene	9.5	15.1	37	Hydrogen iodide	9.0	21.3	51	Propylene	9.0	13.8
10	Butylene	8.9	13.0	24	Fluorine	7.3	23.8	38	Hydrogen sulfide	8.6	18.0	52	Sulfur dioxide	9.6	17.0
11	Carbon dioxide	9.5	18.7	25	Freon-11	10.6	15.1	39	Iodine	9.0	18.4	53	Toluene	8.6	12.4
12	Carbon disulfide	8.0	16.0	26	Freon-12	11.1	16.0	40	Mercury	5.3	22.9	54	2, 3, 3-Trimethylbutane	9.5	10.5
13	Carbon monoxide	11.0	20.0	27	Freon-21	10.8	15.3	41	Methane	9.9	15.5	55	Water	8.0	16.0
14	Chlorine	9.0	18.4	28	Freon-22	10.1	17.0	42	Methyl alcohol	8.5	15.6	56	Xenon	9.3	23.0

APPENDIX C

EXAMPLE OF ANALYSIS OF EXPERIMENTAL DATA

The original data for 40 atg, 330°C and 7000 hr^{-1} are shown in Figures C.1 and C.2. Figure C.1 shows the raw data obtained from dry gas analysis by gas chromatography using a MS-5A column; the sample is taken at point SP-2. Figure C.2 shows the raw data obtained from wet gas analysis by gas chromatography using a Porapak T column; the sample is taken at point SP-1. Using the above data, the calculation procedure is as follows :

The area under each peak of Figures C.1 and C.2, corresponding to each gas component, is converted to the moles of each respective component with the aid of a previously prepared calibration curve. Since the 0.5-ml samples taken at SP-1 and SP-2 are different in that the SP-2 sample is dry but the SP-1 sample is wet. Thus it is necessary to take this into account when carrying out data analysis, as follows.

Let a = moles of dry gas contained in the 0.5-ml sample taken at SP-2 at 32°C and detected by MS-5A (that is, the sum of CO, H_2, and CH_4).

b = moles of wet gas contained in the 0.5-ml sample taken at Sp-1 at 100°C and detected by Porapak T (that is, the sum of CH_3OH, CH_3OCH_3, C_2H_6, C_3H_8, CO_2, and H_2O).

c = moles of condensible vapors in the wet gas (that is, moles of water and methanol).

d = temperature conversion factor (from $100^{o}C$ to $32^{o}C$)

$$= \frac{273 + 100}{273 + 32} = 1.223$$

F = total moles of wet gas

Next let

$$X = \frac{C}{F-C} \qquad \text{-----(C.1)}$$

Then total wet gas

$$F = \frac{a}{1+x} \cdot \frac{1}{d} + b \qquad \text{-----(C.2)}$$

From equations (C.1) and (C.2)

$$C\left(\frac{1+x}{x}\right) = \frac{a}{1+x} \cdot \frac{1}{d} + b$$

or

$$(c-b)x^2 + \left(2c-\frac{a}{d}-b\right) x + c = o$$

Thus

$$x = \frac{-\alpha-\gamma}{2\beta}$$

Where

$$\beta = c-b$$

$$\alpha = \left(2C-\frac{a}{d}-b\right)$$

$$\gamma = \sqrt{\alpha^2-4\beta C}$$

The moles of dry gas at SP-2 can be converted to that of wet gas at SP-1 by mutiplying with $\frac{1}{d} \cdot \frac{1}{1+x}$.

Since the feed gas (synthesis gas) contains H_2 and CO at a ratio of 2 to 1, the atomic ratios of H:C, C:O, and H:O in the feed are 4:1, 1:1, and 4:1, respectively. This fact is used in carrying out C, H and O balances to account for those hydrocarbons (C_4H_{10}, etc.) that can not be detected.

Total CO conversion (%) and product selectivity (%) can be calculated as follows.

$$\text{Total CO conversion}(\%) = \frac{\text{total g-atom of C that is converted}}{\text{sum of g-atom of C in feed}} \times 100$$

$$\text{Product selectivity } (\%) = \frac{\text{g-atom of C that is converted to the product}}{\text{total g-atm of C that is converted}} \times 100$$

$$\text{Space time yield of a product} = \frac{(\%\text{total CO conversion}) \times (\%\text{selectivity})}{22.4 \times 3 \times 100 \times 100} \times \text{GHSV} \quad \text{(mol/l-cat.hr)}$$

Specifically , from Table C.1 we have

$$a = 11.16 \times 10^{-6} \text{ mol}$$

$$b = 4.82 \times 10^{-7} \text{ mol}$$

$$c = 1.95 \times 10^{-7} \text{ mol}$$

$$d = 1.223 \text{ mol}$$

Therefore $x = 0.02114$

and $\frac{1}{d} \cdot \frac{1}{1+x} = \frac{1}{1.223} \cdot \frac{1}{1+0.02114} = 0.800734$

Thus

$$\text{moles of CO in wet gas} = 3.8\times10^{-6} \times 0.800734 = 3.0428\times10^{-6} \text{ mol}$$

$$\text{moles of } H_2 \text{ in wet gas} = 72.5\times10^{-7} \times 0.800734 = 5.805308\times10^{-6} \text{ mol}$$

$$\text{moles of } CH_4 \text{ in wet gas} = 1.1\times10^{-7} \times 0.800734 = 8.808 \times10^{-8} \text{ mol}$$

Therefore the products contained in wet gas are :

CO	=	3.0428×10^{-6}	mol
H_2	=	5.805308×10^{-6}	mol
CH_4	=	8.808×10^{-8}	mol
C_2H_6	=	0.7×10^{-8}	mol
C_3H_8	=	0	mol
CO_2	=	$2.8-10^{-7}$	mol
CH_3OCH_3	=	0	mol
CH_3OH	=	1.75×10^{-7}	mol
H_2O	=	0.02×10^{-6}	mol

Hence the g-atoms of C,H, and O are found to be 3.59988×10^{-6}. 1.2744938×10^{-5}, and 3.7978×10^{-6}, respectively. The ratios of C/O, H/O, and H/C are 0.948, 3.356, and 3.54, respectively. After accounting for undetected compounds, the g-atoms of C,H, and O become 3.7978×10^{-6}, 1.51912×10^{-5}, and 3.7978×10^{-6}, respectively.

So the g-atoms of C that are converted $= 3.7978 \times 10^{-6} - 3.0428 \times 10^{-6}$

$= 0.755 \times 10^{-6}$ mol

and the total CO conversion $= \frac{0.755 \times 10^{-6}}{3.7978 \times 10^{-6}} \times 100$

$= 19.88\%$

Similarly,

CH_4 selectivity $= \frac{8.808 \times 10^{-8}}{0.755 \times 10^{-6}} \times 100$

$= 11.67\%$

C_2H_6 selectivity $= \frac{1.4 \times 10^{-8}}{0.755 \times 10^{-6}} \times 100$

$= 1.85\%$

C_3H_8 selectivity = 0

CO_2 selectivity = $\frac{2.8\times10^{-7}}{0.755\times10^{-6}} \times 100 = 37.09\%$

CH_3OCH_3 selectivity = 0

CH_3OH selectivity = $\frac{1.75\times10^{-7}}{0.755\times10^{-6}} \times 100 = 23.18\%$

and

Space-time yield of methanol = $\frac{7000\times19.88\times23.18}{22.4\times3\times100\times100}$

= 4.8 mol/l-cat.hr

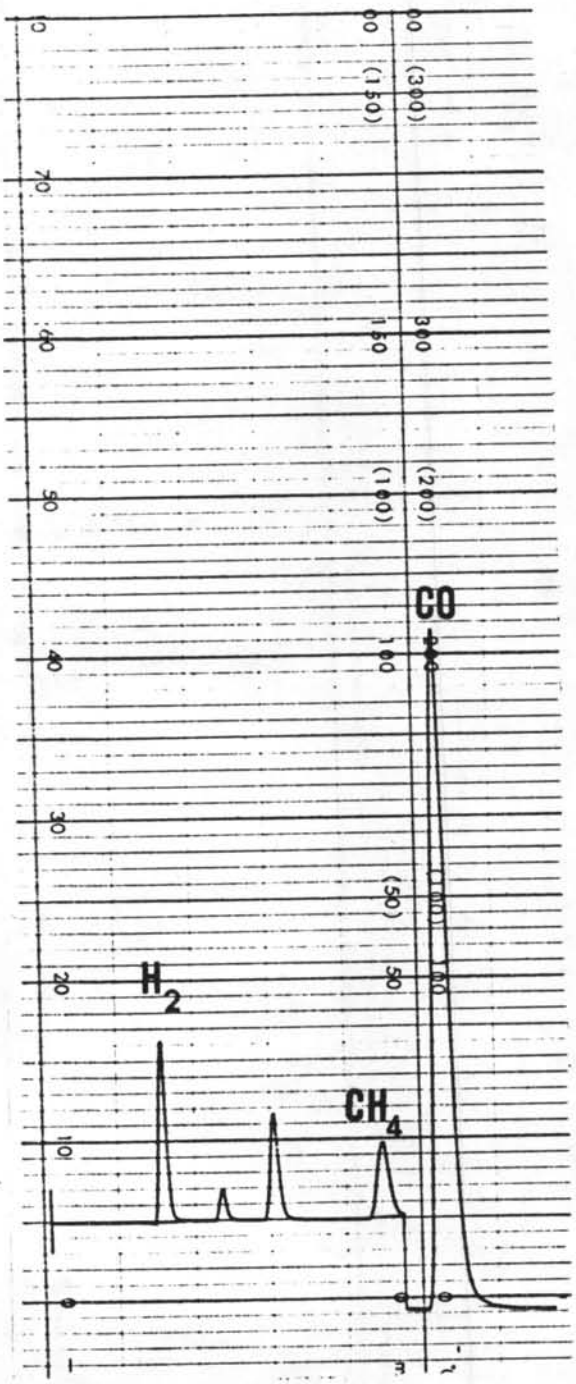


Figure C.1 Gas Chromatography Obtained with a MS-5A Column

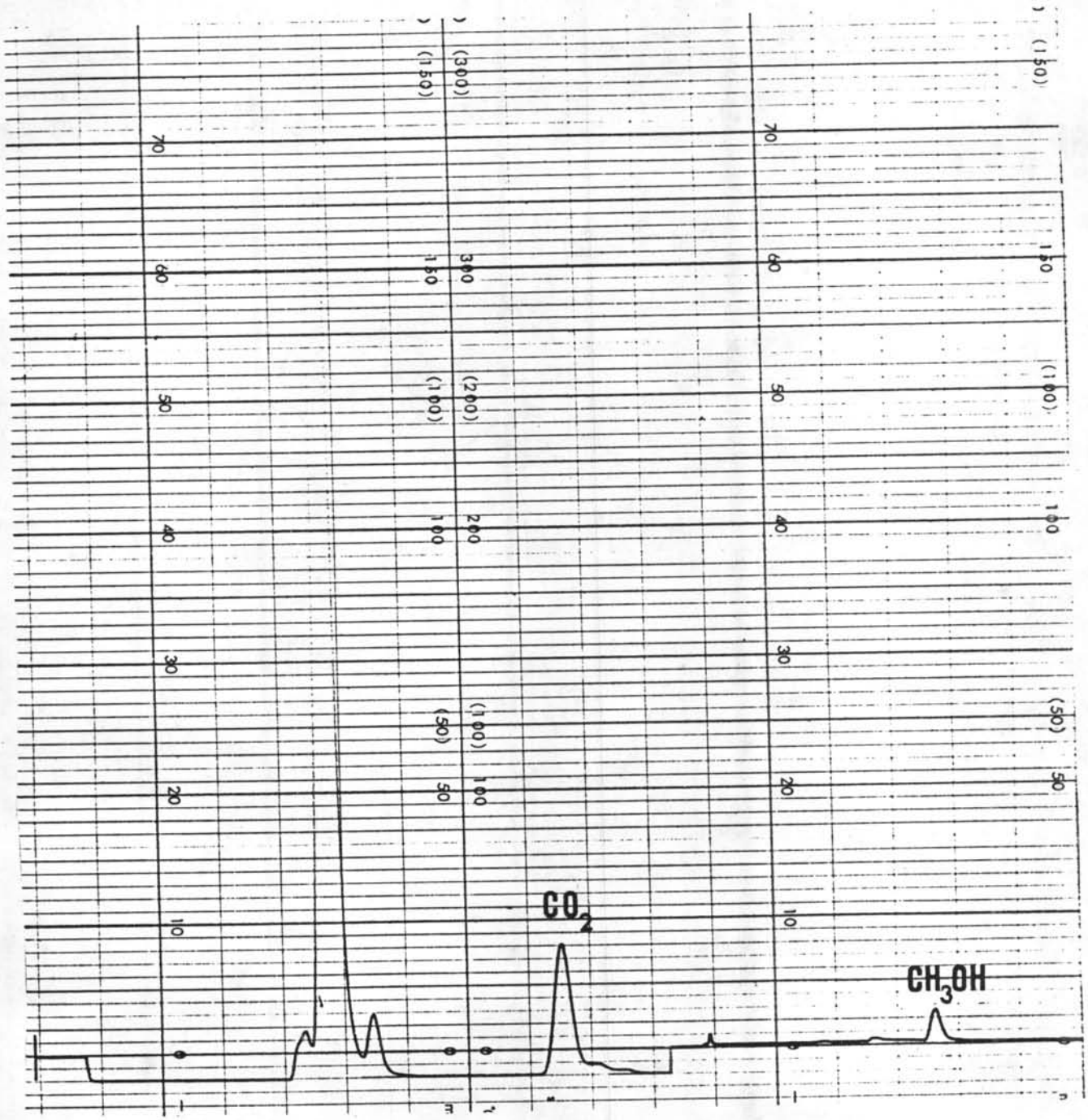


Figure C.2 Gas Chromatography Obtained with a Porapak T Column

Table C.1 Experimental Data

Reaction Conditions : 40 atg, 7000 hr^{-1}, 330 ^{o}C

	Raw Data					Total	g-atom			CO Concersion = 19.88%	Reaction
	Dry Gas (32°C)		Wet Gas (100°C)			Wet Gas					
	Area cm^2	0.5 c.c mol	Area cm^2	0.5 c.c mol	1.0 c.c mol	0.5 c.c mol	C	H	O	Product Selectivity(%)	
CO	1.82	3.8×10^{-6}	-	-	-	3.0428×10^{-6}	3.0428×10^{-6}	-	3.0428×10^{-6}	-	
H_2	.242	72.5×10^{-7}	-	-	-	5.805308×1^{-6}	-	1.1610616×10^{-5}	-	-	
CH_4	.2	1.1×10^{-7}	-	-	-	8.808×10^{-8}	8.808×10^{-8}	3.523×10^{-7}	-	11.67	$CO + 3H_2 \rightarrow CH_4 + H_2O$
C_2H_6	-	-	0.0175	0.7×10^{-8}	-	0.7×10^{-8}	1.4×10^{-8}	4.2×10^{-8}	-	1.85	$2CO + 5H_2 \rightarrow C_2H_6 + 2H_2O$
C_3H_8	-	-	0	0	-	0	0	0	-	0	$3CO + 7H_2 \rightarrow C_3H_8 + 3H_2O$
CO_2	-	-	0.753	2.8×10^{-7}	-	2.8×10^{-7}	-	5.6×10^{-7}		37.09	$CO + H_2O \rightarrow CO_2 + H_2$
CH_3OCH_3	-	-	0	0	-	0	0	0	0	0	$2CO + 2H_2 \rightarrow CH_3OCH_3 + H_2O$
CH_3OH	-	-	0.1	1.75×10^{-7}	-	1.75×10^{-7}	1.75×1^{-7}	7×10^{-7}	1.75×10^{-7}	23.18	$CO + 2H_2 \rightarrow CH_3OH$
H_2O	-	-	7.5×10^{-3}	0.02×10^{-6}	-	0.02×10^{-6}	-	0.04×10^{-6}	0.02×10^{-6}	0	-
C_mH_n	-	-	-	-	-	-	(1.9792×10^{-7})	(2.44626×10^{-4})	-	26.21	$mCO + (\frac{n}{2} + m)H_2 \rightarrow C_mH_4 + mH_2O$
Other	-	-	-	-	-	-	-	-	-	-	-
Total		11.16×10^{-6}		4.82×10^{-7}		9.41817×10^{-6}	3.59988×10^{-6}	1.2744938×10^{-5}	3.7978×10^{-6}	100	C:O = 0.948:1
Total adjust							(3.7978×10^{-6})	(1.51912×10^{-5})	(3.7978×10^{-6})		H:O = 3.356:1
											H:C = 3.54 :1

	a	d = 1.223	b	c = 1.95×10^{-7}
$\alpha = 2c-\frac{a}{d}-b$		-9.2171022×10^{-6}		
$\beta = c-b$		-2.87×10^{-7}		
$\gamma = \alpha^2-48c$		9.229238×10^{-6}		
$x = \frac{-\alpha-\gamma}{28}$		0.02114		

APPENDIX D

RESULTS OF EXPERIMENT

D-1 Results of Experiment at 40 atg, 1700 hr^{-1}

Reaction Condition P = 40 atg

GHSV = 1700 hr^{-1}

Reaction Temperature (°C)		281	301	330	360	380
Product Selectivity	CH_3OH (%)	64.79	44.02	9.20	2.44	-
	CO_2 (%)	13.38	26.32	43.68	46.77	-
	CH_4 (%)	3.50	4.77	7.17	21.60	-
	C_2H_6 (%)	0.84	1.24	5.52	7.19	-
	C_3H_8 (%)	0	0.86	2.87	3.66	-
	C_2H_4 (%)	-	-	-	-	-
	C_3H_6 (%)	-	-	-	-	-
	CH_3OCH_3 (%)	0	2.87	1.15	0.35	-
	other H.C(%)	17.49	19.92	30.42	17.98	-
	total H.C(%)	21.83	26.79	45.98	50.43	
Conversion of CO (%)		15.00	21.48	42.94	48.95	-
Space-Time Yield of CH_3OH, (mol/l-cat.hr)		2.399	2.334	0.975	0.295	-

D-2 Results of Experiment at 40 atg, 3900 hr^{-1}

Reaction Condition P = 40 atg

GHSV = 3900 hr^{-1}

Reaction Temperature (°C)		277	302	332	360	380
Product Selectivity	CH_3OH (%)	6.93	1.26	0.47	1.54	-
	CO_2 (%)	45.54	37.97	44.39	45.77	-
	CH_4 (%)	8.01	19.39	16.23	18.33	-
	C_2H_6 (%)	5.54	8.23	8.64	7.92	-
	C_3H_8 (%)	4.46	5.98	4.42	2.88	-
	C_2H_4 (%)	-	-	-	-	-
	C_3H_6 (%)	-	-	-	-	-
	CH_3OCH_3 (%)	0	0	0	0	-
	other H.C(%)	29.51	27.16	25.85	23.55	-
	total H.C(%)	47.52	60.76	55.14	52.68	-
Conversion of CO (%)		26.85	62.10	79.84	64.52	-
Space-Time Yield of CH_3OH, (mol/l-cat.hr)		1.068	0.449	0.215	0.570	-

D-3 Results of Experiment at 40 atg, 7000 hr^{-1}

Reaction Condition P = 40 atg

GHSV = 7000 hr^{-1}

Reaction Temperature (^{o}C)		281	301	330	360	380
Product Selectivity	CH_3OH (%)	11.43	1.60	23.18	8.00	4.86
	CO_2 (%)	44.28	40.00	37.09	44.67	46.18
	CH_4 (%)	9.31	5.13	11.69	15.00	14.30
	C_2H_6 (%)	1.88	7.60	1.85	4.13	5.00
	C_3H_8 (%)	0	4.56	0	0.60	0.65
	C_2H_4 (%)	-	-	-	-	-
	C_3H_6 (%)	-	-	-	-	-
	CH_3OCH_3 (%)	0	0	0	0	0
	other H.C(%)	33.09	41.11	26.21	27.60	29.04
	total H.C(%)	44.28	58.40	39.75	47.33	48.99
Conversion of CO (%)		9.59	48.25	19.88	36.48	36.90
Space-Time Yield of CH_3OH, (mol/l-cat.hr)		1.148	0.808	4.826	3.056	1.878

D-4 Results of Experiment at 40 atg, 16000 hr^{-1}

Reaction Condition P = 40 atg

GHSV = 16000 hr^{-1}

Reaction Temperature (°C)		280	302	332	360	380
Product Selectivity	CH_3OH (%)	7.69	0	0	2.36	-
	CO_2 (%)	42.31	37.97	43.96	47.17	-
	CH_4 (%)	9.40	13.20	12.00	8.34	-
	C_2H_6 (%)	2.31	8.66	6.37	4.06	-
	C_3H_8 (%)	0	4.81	2.97	1.70	-
	C_2H_4 (%)	-	-	-	-	-
	C_3H_6 (%)	-	-	-	-	-
	CH_3OCH_3 (%)	0	0	0	0	-
	other H.C(%)	38.29	35.36	34.70	36.38	-
	total H.C(%)	50.00	62.03	56.04	50.48	-
Conversion of CO (%)		6.99	46.85	47.32	53.42	-
Space-Time Yield of CH_3OH, (mol/l-cat.hr)		1.250	0	0	2.930	-

D-5 Results of Experiments at 30 atg, 2400 hr^{-1}

Reaction Condition P = 30 atg

GHSV = 2400 hr^{-1}

Reaction Temperature (^{o}C)		300	320	340	360	380
Product Selectivity	CH_3OH (%)	40.80	6.17	4.92	3.86	4.60
	CO_2 (%)	27.86	46.19	46.72	47.38	45.98
	CH_4 (%)	3.27	5.05	6.79	8.73	13.83
	C_2H_6 (%)	1.29	3.12	2.95	2.31	3.22
	C_3H_8 (%)	0	1.36	1.11	0.99	1.03
	C_2H_4 (%)	-	-	-	-	-
	C_3H_6 (%)	-	-	-	-	-
	CH_3OCH_3 (%)	2.98	0	0	0.55	2.30
	other H.C(%)	23.80	38.10	37.51	36.17	29.04
	total H.C(%)	28.36	47.63	48.36	48.20	47.12
Conversion of CO (%)		26.46	56.64	49.32	39.02	20.60
Space-Time Yield of CH_3OH, (mol/l-cat.hr)		3.830	1.240	0.860	0.534	0.336

D-6 Results of Experiments at 30 atg, 3500 hr^{-1}

Reaction Condition P = 30 atg

GHSV = 3500 hr^{-1}

Reaction Temperature (^{o}C)		281	300	330	360	380
Product Selectivity	CH_3OH (%)	1.93	0.33	0.25	1.12	-
	CO_2 (%)	22.22	36.88	43.22	46.93	-
	CH_4 (%)	18.58	19.34	20.93	20.65	-
	C_2H_6 (%)	5.60	8.66	7.90	5.64	-
	C_3H_8 (%)	3.62	4.62	3.30	2.09	-
	C_2H_4 (%)	-	-	-	-	-
	C_3H_6 (%)	-	-	-	-	-
	CH_3OCH_3 (%)	0	0	0	0	-
	other H.C(%)	48.04	30.16	24.39	23.57	-
	total H.C(%)	75.84	62.78	56.52	51.95	-
Conversion of CO (%)		39.70	84.87	77.05	61.24	-
Space-Time Yield of CH_3OH, (mol/l-cat.hr)		0.390	0.142	0.098	0.349	-

D-7 Results of Experiments at 30 atg, 6700 hr^{-1}

Reaction Condition P = 30 atg

GHSV = 6700 hr^{-1}

Reaction Temperature (°C)		280	300	331	360	380
Product Selectivity	CH_3OH (%)	1.73	0.74	0.28	1.43	-
	CO_2 (%)	26.01	31.11	41.81	47.06	-
	CH_4 (%)	28.44	25.74	17.98	14.59	-
	C_2H_6 (%)	7.51	7.63	7.06	5.60	-
	C_3H_8 (%)	4.34	4.00	3.47	2.38	-
	C_2H_4 (%)	-	-	-	-	-
	C_3H_6 (%)	-	-	-	-	-
	CH_3OCH_3 (%)	0	0	0	0	-
	other H.C(%)	31.96	30.77	29.40	28.94	-
	total H.C(%)	72.25	68.14	57.91	51.51	-
Conversion of CO (%)		43.62	48.96	61.96	55.75	-
Space-Time Yield of CH_3OH, (mol/l-cat.hr)		0.752	0.361	0.173	0.795	-

D-8 Results of Experiments at 30 atg, 13000 hr^{-1}

Reaction Condition P = 30 atg

GHSV = 13000 hr^{-1}

Reaction Temperature (°C)		280	301	330	360	380
Product Selectivity	CH_3OH (%)	1.04	1.18	0.74	1.59	-
	CO_2 (%)	30.69	31.36	42.26	46.68	-
	CH_4 (%)	7.63	14.64	23.30	17.39	-
	C_2H_6 (%)	8.98	8.22	5.94	4.62	-
	C_3H_8 (%)	4.70	3.82	2.58	1.99	-
	C_2H_4 (%)	-	-	-	-	-
	C_3H_6 (%)	-	-	-	-	-
	CH_3OCH_3 (%)	0	0	0	0	-
	other H.C(%)	46.96	40.77	25.17	27.73	-
	total H.C(%)	68.27	67.45	56.99	51.73	-
Conversion of CO (%)		34.64	31.51	39.26	37.39	-
Space-Time Yield of CH_3OH, (mol/l-cat.hr)		0.719	0.742	0.580	1.186	-

D-9 Results of Experiments at 20 atg, 1600 hr^{-1}

Reaction Condition P = 20 atg

GHSV = 1600 hr^{-1}

Reaction Temperature (°C)		280	301	332	360	380
Product Selectivity	CH_3OH (%)	0.50	0.16	0.17	0	-
	CO_2 (%)	36.47	42.57	42.10	42.90	-
	CH_4 (%)	25.79	19.44	23.99	27.69	-
	C_2H_6 (%)	7.91	9.41	8.63	7.79	-
	C_3H_8 (%)	5.20	5.58	4.41	3.22	-
	C_2H_4 (%)	-	-	-	-	-
	C_3H_6 (%)	-	-	-	-	-
	CH_3OCH_3 (%)	0	0	0	0	-
	other H.C(%)	24.12	22.84	20.69	18.40	-
	total H.C(%)	63.02	57.27	57.72	57.10	-
Conversion of CO (%)		89.74	90.73	87.23	86.09	-
Space-Time Yield of CH_3OH, (mol/l-cat.hr)		0.106	0.034	0.035	0	-

D-10 Results of Experiments at 20 atg, 3700 hr^{-1}

Reaction Condition P = 20 atg

GHSV = 3700 hr^{-1}

Reaction Temperature (^{o}C)		280	301	330	360	380
Product Selectivity	CH_3OH (%)	0.50	0.49	0.813	0.41	-
	CO_2 (%)	36.72	40.98	45.17	44.87	-
	CH_4 (%)	11.47	22.10	20.51	19.17	-
	C_2H_6 (%)	7.24	7.85	5.31	5.64	-
	C_3H_8 (%)	4.47	3.36	2.06	2.30	-
	C_2H_4 (%)	-	-	-	-	-
	C_3H_6 (%)	-	-	-	-	-
	CH_3OCH_3 (%)	0	0	0	0	-
	other H.C(%)	39.60	25.22	26.14	27.61	-
	total H.C(%)	62.78	58.53	54.02	54.72	-
Conversion of CO (%)		56.67	68.99	53.16	66.26	-
Space-Time Yield of CH_3OH, (mol/l-cat.hr)		0.156	0.186	0.237	0.149	-

D-11 Results of Experiments at 20 atg, 6000 hr^{-1}

Reaction Condition P = 20 atg

GHSV = 6000 hr^{-1}

Reaction Temperature (^{o}C)		278	300	330	360	380
Product Selectivity	CH_3OH (%)	1.24	0.75	1.36	1.05	-
	CO_2 (%)	29.24	38.27	47.28	46.96	-
	CH_4 (%)	16.55	21.71	14.32	12.03	-
	C_2H_6 (%)	8.11	7.32	1.63	3.65	-
	C_3H_8 (%)	4.39	3.15	1.55	1.57	-
	C_2H_4 (%)	-	-	-	-	-
	C_3H_6 (%)	-	-	-	-	-
	CH_3OCH_3 (%)	0	0	0	0	-
	other H.C(%)	40.47	28.79	33.86	34.74	-
	total H.C(%)	69.52	60.97	51.36	51.99	-
Conversion of CO (%)		33.63	47.32	37.70	43.84	-
Space-Time Yield of CH_3OH, (mol/l-cat.hr)		0.364	0.310	0.447	0.402	-

D-12 Results of Experiments at 20 atg, 13000 hr^{-1}

Reaction Condition P = 20 atg

GHSV = 13000 hr^{-1}

Reaction Temperature (^{o}C)		278	298	330	360	380
Product Selectivity	CH_3OH (%)	3.45	2.41	0.83	2.94	-
	CO_2 (%)	34.48	34.94	44.63	47.06	-
	CH_4 (%)	15.81	28.79	18.64	16.39	-
	C_2H_6 (%)	5.06	5.18	4.46	2.98	-
	C_3H_8 (%)	3.10	2.71	1.82	1.64	-
	C_2H_4 (%)	-	-	-	-	-
	C_3H_6 (%)	-	-	-	-	-
	CH_3OCH_3 (%)	0	0	0	0	-
	other H.C(%)	38.10	25.97	29.62	28.98	-
	total H.C(%)	62.07	62.65	54.54	49.99	-
Conversion of CO (%)		9.40	17.15	34.65	25.85	-
Space-Time Yield of CH_3OH, (mol/l-cat.hr)		0.629	0.801	0.558	1.473	-

VITA

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