

APPENDIX C
DETAILED DATA OBTAINED WITH DEVELOPMENTAL CATALYST SG-B-2

TABLE C1
HYDROGEN ACTIVATION OF CATALYST SG-B-2 - CHARGE 0.9 H₂ / 1.0 CO/0.3 CO₂/3.2 CH₄

Run	143-59-1	143-59-4	143-59-7	143-61-1	143-61-2	159-135-2	159-135-3	159-135-4	143-62-1	143-62-2	143-62-1	143-62-4
Activation Time & Temp.	0.9	4.5	8.1	1.0	2.0	2.8	3.9	4.9	1.0	2.0	3.0	4.0
Days on Stream	518	520	522	517	520	517	514	519	524	523	524	525
Temp., Inlet	521	522	524	526	529	528	528	527	529	528	529	530
Avg. °F	528	527	528	526	528	528	528	527	529	528	529	530
Max. °F	513	516	519	506	510	503	507	508	513	514	516	517
Outlet °F	200	200	200	200	200	200	200	200	200	200	200	200
Pressure, PSIG	1511	1498	1483	1481	1497	1504	1536	1536	1557	1536	1536	1515
WHSV	1.6	1.6	1.6	1.6	1.7	1.6	1.7	1.7	1.8	1.8	1.8	1.8
Contact Time, sec.	19.1	19.3	19.5	19.5	19.3	19.2	18.8	18.8	18.6	18.9	18.9	19.1
Material Balance, %	101	101	101	100	101	101	100	100	95	101	101	101
CO Conv. %	32	23	17	37	36	35	34	32	30	29	27	26
to HC %	91	97	99	92	96	92	92	92	94	94	95	95
H ₂ Conv. %	85	72	57	86	81	86	82	77	76	70	66	65
to HC %	61	64	67	62	52	64	60	59	57	60	56	59
Total Conv. %	36	26	20	40	38	38	37	34	32	32	29	29
G HC/m ³ CO	160	123	97	231	178	219	185	178	157	182	153	161
HC Selectivity, % wt.	6	11	17	13	10	17	21	26	8	18	8	18
C ₁	16	17	20	11	16	11	13	14	14	14	16	16
C ₂	11	11	7	5	8	8	7	8	9	8	9	8
C ₃	25	26	20	19	22	32	19	19	26	20	22	18
C ₄	12	12	12	13	10	4	11	9	12	9	9	10
C ₅ ⁺	30	24	24	39	34	28	29	24	31	31	36	29
Olefin Selectivity, % wt.	14	16	2	2	12	14	14	14	2	14	14	14
C ₂	2	1	5	33	3	2	3	3	3	3	3	3
C ₃	1	1	2	8	1	5	1	1	1	1	1	1
C ₄	7	10	12	7	8	9	9	9	4	6	7	7
C ₅	1	1	1	1	1	2	1	1	1	1	2	2
C ₅ Olefin Selectivity, % wt.	17	17	16	17	17	18	18	18	81	82	81	17
1-pentene	82	82	83	82	82	80	81	82	81	82	81	81
2-pentene	45	42	55	55	58	52	48	42	52	52	58	60
Methylbutenes	356	327	360	372	370	368	331	322	315	355	330	NA
C ₆ ⁺ Aromatics, % wt.												
90% CH ₄ , °F												

TABLE C2

 SYNTHESIS GAS CONVERSION OVER CATALYST SG-B-2 WITH
 H_2/CO AT 200 PSIG AND 507°F

Run	CT-143	58-4	58-5
Catalyst	SG-	B-2	B-2
Charge (mole)	$H_2/CO/CO_2/$	1/1/0	1/1/0
Temp., Inlet.	°F	492	495
	Avg.	499	502
	Max.	506	507
	Outlet	492	495
Pressure, PSIG		200	200
	GHSV	1457	1457
	WHSV	1.3	1.3
Contact Time, sec.		19.8	19.8
Material Balance, %		102	101
CO Conv.	% Wt.	34	33
	to HC	99	99
H_2 Conv.	% Wt.	68	66
	to HC	56	56
Total Conv.	% Wt.	37	35
G HC/m ³ CO		198	190
HC Selectivity, % Wt.			
	C ₁	15	16
	C ₂	2	2
	C ₃	2	4
	C ₄	9	8
	C ₅₊	13	12
	C ₆	59	58
Olefin Selectivity, % Wt.			
	C ₂	25	25
	C ₃	3	37
	C ₄	53	57
	C ₅	67	71
C ₅ Olefin Selectivity, % Wt.			
	1-pentene	2	2
	2-pentene	17	17
	Methylbutenes	81	81
C ₆ ⁺ Aromatics, % Wt.		14	11
	90% OH, °F	398	396

TABLE C3

EFFECT OF TEMPERATURE FOR SYNTHESIS GAS CONVERSION OVER
CATALYST SG-B-2 WITH H₂/CO AT 200 PSIG

Run	58-6	58-7	58-8	58-9	58-10	58-11
CT-143						
Catalyst SG-	B-2	B-2	B-2	B-2	B-2	B-2
Charge (mole) H ₂ /CO/CO ₂ /	1/1/0	1/1/0	1/1/0	1/1/0	1/1/0	1/1/0
Temp., Inlet. °F	478	510	531	552	575	504
Av. °F	481	519	540	563	586	508
Max. °F	484	525	552	577	602	510
Outlet °F	477	509	528	548	571	503
Pressure, PSIG	200	200	200	200	200	200
GHSV	1457	1457	1457	1457	1457	1457
WHSV	1.3	1.3	1.3	1.3	1.3	1.3
Contact Time, sec.	19.8	19.8	19.8	19.8	19.8	19.8
Material Balance, %	101	101	105	104	103	103
CO Conv. % Wt.	20	38	42	47	48	15
to HC % Wt.	99	99	98	95	93	99
H ₂ Conv. % Wt.	43	79	85	90	91	37
to HC % Wt.	58	59	61	63	66	65
Total Conv. % Wt.	22	41	45	50	51	17
G HC/m ³ CO	122	222	240	256	262	95
HC Selectivity, % Wt.						
C ₁	17	21	28	37	48	34
C ₂	2	2	3	3	4	2
C ₃	4	3	3	4	4	4
C ₄	11	8	10	10	10	14
C ₅	12	11	11	9	7	10
C ₆	54	54	45	37	27	36
Olefin Selectivity, % Wt.						
C ₂	<1	18	13	10	10	50
C ₃	38	13	31	9	9	4
C ₄	65	47	29	13	8	45
C ₅	78	64	39	19	11	56
C ₅ Olefin Selectivity, % Wt.						
1-pentene	2	2	2	2	2	2
2-pentene	18	17	16	16	18	16
Methylbutenes	80	81	82	82	80	82
C ₆ ⁺ Aromatics, % Wt.	11	17	20	37	55	26
90% OH, °F	394	367	356	348	373	377

TABLE C4

EFFECT OF TEMPERATURE FOR SYNTHESIS GAS CONVERSION OVER
CATALYST SG-B-2 AT 200 PSIG WITH 2/1 H₂/CO

CT-158-	99-1	99-2	99-3	99-4	99-5	99-6
Temperature, Inlet, °F	450	476	490	450	474	486
Average, °F	460	483	498	452	483	496
Maximum, °F	460	500	518	460	498	515
Outlet, °F	447	473	487	448	474	485
GHSV	1406	1406	1406	1428	1428	1428
WHSV	1.3	1.3	1.3	1.0	1.0	1.0
Contact Time, sec.	21.1	20.6	20.3	21.0	20.3	20.0
Material Balance, % wt	97	101	100	101	100	102
CO Conversion, % wt	17	35	39	30	63	71
To HC, % wt	99	99	98	100	99	98
H ₂ Conversion, % wt	32	64	75	31	67	78
To HC, % wt	41	51	53	50	55	58
Total Conversion, % wt	18	37	41	30	64	72
gm HC/m ³ CO	69	203	216	162	363	419
HC Selectivity, % wt						
C ₁	19	13	18	22	21	25
C ₂	3	2	2	2	3	3
C ₃	8	3	3	5	4	4
C ₄	11	9	11	9	9	9
C ₅	17	14	14	11	13	13
C ₆ ⁺	42	59	51	52	50	46
Olefin Selectivity, % wt						
C ₂	50	25	17	33	7	5
C ₃	40	28	40	25	26	15
C ₄	61	54	50	57	48	39
C ₅	69	72	66	75	63	56
C ₅ Olefin Selectivity, % wt						
1-Pentene	2	2	2	2	2	2
2-Pentene	17	16	16	20	17	16
Methylbutenes	81	82	83	77	81	82
Aromatics in C ₆ ⁺ , % wt	0	10	11	9	9	7
90% OH, °F	650	393	380	396	393	362

TABLE C5

SYNTHESIS GAS CONVERSION OVER CATALYST SG-B-2
AT VARYING CONTACT TIME AND PRESSURE

Run	CT-143	59-1	59-2	59-3	59-4	59-5	59-6	59-7
Catalyst	SG-	B-2	B-2	B-2	B-2	B-2	B-2	B-2
Charge (mole)	H ₂ /CO/CO ₂ /CH ₄	← 0.9/1.0/0.3/3/4 →						
Temp., Inlet.	°F	518	522	519	520	521	523	522
	Avg. °F	521	523	523	522	524	525	524
	Max. °F	528	528	528	527	527	527	528
	Outlet °F	513	517	516	516	519	520	519
Pressure, PSIG		200	200	200	200	100	100	200
	GHSV	1511	774	2780	1498	1538	774	1483
	WHSV	1.6	0.8	3.0	1.6	1.6	0.8	1.6
Contact Time, sec.		19.1	37.2	10.4	19.3	10.0	19.9	19.5
Material Balance, %		101	99	102	101	102	98	101
CO Conv.	% Wt.	32	38	12	23	13	21	17
	to HC % Wt.	91	88	99	97	99	95	99
H ₂ Conv.	% Wt.	85	85	47	72	52	62	57
	to HC % Wt.	61	61	53	64	67	66	67
Total Conv.	% Wt.	36	41	14	26	15	23	20
G HC/m ³ CO		171	215	114	138	86	131	116
HC Selectivity, % Wt.								
	C ₁	6	8	<1	11	11	16	17
	C ₂	16	14	25	17	27	18	20
	C ₃	11	10	7	11	9	9	7
	C ₄	25	25	21	26	23	27	20
	C ₅	12	17	24	12	2	8	12
	C ₆ ⁺	30	26	23	24	34	22	24
Olefin Selectivity, % Wt.								
	C ₂	14	12	15	16	21	17	2
	C ₃	2	2	5	3	5	3	5
	C ₄	1	1	2	1	2	1	2
	C ₅	7	4	20	10	18	11	12
C ₅ Olefin Selectivity, % Wt.								
	1-pentene	1	1	1	1	1	1	1
	2-pentene	17	18	16	17	17	17	16
	Methylbutenes	82	81	83	82	82	82	83
C ₆ ⁺ Aromatics, % Wt.		45	54	43	42	61	64	55
	90% OH, °F	356	378	334	327	336	336	360

TABLE C6

SYNTHESIS GAS CONVERSION OVER SG-B-2 WITH H₂/CO AND DILUTED H₂/CO AS CHARGE

Item No.	1	2	3	4	5	6	7
Unit	143	158	159	159	143	158	158
Run	58-7	100-2	136-2	136-3	59-1	101-1	101-2
Charge (mole)	1/1/0/0	1/1/0/0	1/1/0/0	1/1/0/0	0.9/1.0/0.3/3.4	0.8/1.0/0.2/3.1	0.8/1.0/0.2/3.1
Temp., Inlet °F	510	518	515	515	518	501	505
°F Avg.	519	518	515	515	515	505	511
°F Max.	525	525	524	524	528	522	531
°F Outlet	509	512	506	506	517	493	499
Pressure, PSIG	200	65	60	60	200	540	540
Partial Press. CO, PSIA	107	40	37	37	38	109	109
Partial Press. CO ₂ , PSIA	1457	545	557	557	4572	4572	4572
GHSV, Total	728	272	274	274	270	896	896
GHSV on CO	1.3	0.6	0.5	0.5	1.6	5.3	5.3
WHSV	19.8	16.3	17.5	17.5	19.1	16.7	16.7
Contact Time, Sec.	101	96	102	100	101	100	102
Material Balance, %							
CO Conversion, % Wt.	38	43	40	38	32	30	29
to HC % Wt.	99	91	92	92	91	98	98
H ₂ Conversion, % Wt.	79	80	79	75	85	69	69
Total C ₂ C ₃ CO	41	45	43	41	36	32	31
Gm HC/m ³ CO	222	229	195	201	160	178	180
HC Selectivity, % Wt.							
C ₁	21	34	39	37	6	7	11
C ₂	2	3	4	3	16	14	12
C ₃	3	5	6	5	11	6	6
C ₄	8	13	15	14	25	22	18
C ₅	11	10	9	9	12	12	11
C ₅ ⁺	54	35	27	32	30	39	42
C ₆ ⁺	64	6	7	8	7	35	40
Olefin in C ₅ , Wt. %							
C ₅ Olefin Selectivity, % Wt.							
1-Pentene	2	4	2	2	1	1	1
2-Pentenes	17	19	16	17	17	14	14
Methylbutenes	81	77	82	81	82	85	85
C ₆ ⁺ Aromatics, % Wt.	17	57	52	59	45	31	30
90% OH, °F	367	339	338	354	356	373	371

TABLE C7

COMPARISON OF H_2/CO AND $0.9H_2/1.0CO/0.3CO_2/3.2CH_4$ OVER SG-B-2 AT 750 GHSV(WHSV = 0.7 - 0.8 Activation: 950°F, 16 Hr. H_2 0 PSIG)

Unit	158	158	158	143	143	143
Run	102-3	102-4	102-5	60-1	60-2	60-3
Charge (mole) $H_2/CO/CO_2/C_1$	1/1/0/0			0.9/1/.3/3.2		
Days on Stream	5.8	7.8	9.8	1.9	3.9	6.9
Temp., Inlet °F	473	473	475	481	482	482
Avg. °F	470	470	472	482	483	483
Max. °F	485	485	486	485	485	485
Outlet °F	460	460	461	477	479	478
Pressure, PSIG	200	200	200	200	200	200
Partial Press. CO, PSIA	107	107	107	40	40	40
GHSV Total	720	720	720	772	772	772
GHSV on CO	360	360	360	143	143	143
Contact Time, Sec.	41.3	41.3	41.3	38.6	38.6	38.6
Material Balance %	100	98	100	99	100	99
CO Conversion, % Wt.	35	33	36	33	30	29
to HC % Wt.	99	100	99	97	97	97
H_2 Conversion, % Wt.	68	64	67	78	76	71
to HC % Wt.	51	49	49	53	56	55
Total Conv. $CO+H_2$, % Wt.	37	35	38	35	33	31
Gm HC/m ³ CO	201	192	207	188	207	190
HC Selectivity % Wt.						
C ₁	15	15	15	18	15	21
C ₂	2	1	2	11	11	13
C ₃	3	2	1	7	7	6
C ₄	8	8	7	16	18	16
C ₅	13	14	14	13	10	10
C ₆ ⁺	59	60	61	35	39	34
Olefin Selectivity, % Wt.						
C ₂	5	33	26	16	2	14
C ₃	42	24	47	3	3	4
C ₄	67	67	68	1	20	13
C ₅	76	80	80	11	21	20
C ₅ Olefin Selectivity, % Wt.						
1-pentene	2	2	2	1	1	1
2-pentene	16	16	16	17	15	15
Methylbutenes	82	82	82	82	84	84
Aromatics in C ₆ ⁺ , % Wt.	8	8	8	41	39	22
90% OH, °F	396	376	362	-	372	360

TABLE C8

PROCESSING A NITROGEN DILUTED 1/1 H₂/CO
CHARGE OVER SG-B-2 AT 700 GHSV

(1.1 WHSV Activation: 600°F, 16 Hr, H₂, 200 PSIG)

Unit	143	143	143
Run	63-1	63-2	63-3
Charge (mole) H ₂ /CO/CO ₂ /N ₂	.9/1/.3/3.5		
Days On-Stream	2.0	4.0	7.0
Temp., Inlet °F	482	483	483
Avg. °F	479	481	481
Max. °F	485	486	486
Outlet °F	472	474	474
Pressure, PSIG	200	200	200
Partial Press. CO, PSIA	35	35	35
GHSV Total	664	664	690
GHSV on CO	116	116	121
Contact Time, Sec.	44.8	44.8	43.1
Material Balance %	104	101	104
CO Conversion, % Wt.	36	33	30
to HC % Wt.	94	93	95
H ₂ Conversion, % Wt.	86	86	78
to HC % Wt.	53	57	56
Total Conv. CO+H ₂ , % Wt.	39	36	33
Gm HC/m ³ CO	208	197	176
HC Selectivity, % Wt.			
C ₁	16	20	22
C ₂	3	0	0
C ₃	5	6	6
C ₄	20	18	11
C ₅	13	7	8
C ₆ ⁺	43	49	53
Olefin Selectivity, % Wt.			
C ₂	11	0	0
C ₃	5	5	50
C ₄	15	17	35
C ₅	14	34	52
C ₅ Olefin Selectivity, % Wt.			
1-pentene	1	1	1
2-pentene	15	14	15
Methylbutenes	84	85	84
Aromatics in C ₆ ⁺ , % Wt.	35	21	15
90% OH, °F	367	361	354

TABLE C9

EFFECT OF ELIMINATING CO₂ FROM DILUTED
1/1 H₂/CO CHARGE OVER SG-B-2 AT 750 GHSV(0.8 WHSV Activation: 159-137 950°F, 16 Hr, H₂ 0 PSIG;
159-138 600°F, 16 Hr, H₂, 200 PSIG)

Unit	159	159	159	159
Run	137-2	137-3	138-2	138-3
Charge (mole) H ₂ /CO/CO ₂ /C ₁	.9/1/0/3.1			
Days On-Stream	4.0	5.9	3.9	5.9
Temp., Inlet °F	474	481	480	482
Avg. °F	479	478	476	479
Max. °F	486	485	485	485
Outlet °F	468	468	466	469
Pressure, PSIG	200	200	200	200
Partial Press. CO, PSIA	40	40	40	40
GHSV Total	779	779	723	713
GHSV on CO	156	156	145	143
Contact Time, Sec.	37.2	37.2	40.0	40.6
Material Balance, %	101	100	100	100
CO Conversion, % Wt.	35	34	35	34
to HC % Wt.	95	95	96	96
H ₂ Conversion, % Wt.	81	77	77	77
to HC % Wt.	54	52	52	55
Total Conv. CO+H ₂ , % Wt.	37	37	38	37
Gm HC/m ³ CO	182	177	194	201
HC Selectivity, % Wt.				
C ₁	22	23	25	25
C ₂	8	8	8	8
C ₃	5	3	5	4
C ₄	10	15	12	12
C ₅	10	11	12	10
C ₅₊	45	40	39	42
Olefin Selectivity, % Wt.				
C ₂	20	20	20	20
C ₃	0	50	0	0
C ₄	4	14	16	17
C ₅	24	38	27	37
C ₅ Olefin Selectivity, % Wt.				
1-Pentene	1	1	1	1
2-Pentene	14	13	13	12
Methylbutenes	85	86	86	87
Aromatics in C ₆ +, % Wt.	28	21	27	24
90% OH, °F	358	354	334	361

TABLE C10

AGING STUDY OF SG-B-2 AT 485 °F

Run	CT-143	60-1	60-2	60-3	60-4	60-5
Catalyst	SG-	B-2	B-2	B-2	B-2	B-2
Charge (mole)	H ₂ /CO/CO ₂ /CH ₄	← 0.9/1/0.3/3.2 →				
Temp., Inlet	°F	481	482	482	482	482
	Avg. °F	482	483	483	482	483
	Max. °F	484	485	485	485	485
	Outlet °F	477	479	478	478	478
Pressure,	PSIG	200	200	200	200	200
	GHSV	772	772	772	772	772
	WHSV	0.8	0.8	0.8	0.8	0.8
Days On-Stream		1.9	3.9	6.9	8.9	10.9
Contact Time, sec.		38.6	38.6	38.6	38.6	38.6
Material Balance, %		99	100	99	96	96
CO Conv.	% Wt.	33	30	29	27	27
	to HC % Wt.	97	97	97	98	97
H ₂ Conv.	% Wt.	78	76	71	71	66
	to HC % Wt.	53	56	55	57	51
Total Conv.	% Wt.	35	33	31	30	29
G HC/m ³ CO		158	207	190	180	162
HC Selectivity, % Wt.						
	C ₁	18	15	21	30	13
	C ₂	11	11	13	12	14
	C ₃	7	7	6	4	4
	C ₄	16	18	16	12	16
	C ₅	13	10	10	8	12
	C ₆ ⁺	35	39	34	34	41
Olefin Selectivity, % Wt.						
	C ₂	16	2	14	16	2
	C ₃	3	3	4	5	5
	C ₄	1	20	13	16	29
	C ₅	11	21	30	37	44
C ₅ Olefin Selectivity, % Wt.						
	1-pentene	1	1	1	1	1
	2-pentene	17	15	15	15	15
	Methylbutenes	82	84	84	84	84
C ₆ ⁺ Aromatics, % Wt.		41	39	22	24	23
	90% OH, °F	NA	372	NA	NA	NA

TABLE C11

PROCESSING 0.9 H₂/1.0 CO/0.3 CO₂/3.2 CH₄ OVER REGENERATED SG-B-2

Run	Oxygen Regenerated Catalyst ^a					Hydrogen Regenerated Catalyst ^b				
	143-59-8	143-59-10	143-59-11	159-135-7	159-135-8	159-135-9	159-135-10	159-135-11		
Days on Stream	0.9	2.3	3.3	0.8	1.9	2.9	4.0	5.0		
Temp., Inlet °F	518	520	520	517	519	520	521	521		
Avg. °F	521	523	524	518	518	520	522	522		
Max. °F	527	529	528	526	525	527	528	528		
Outlet °F	514	517	518	510	510	513	515	515		
Pressure, PSIG	200	200	200	200	200	200	200	200		
GHSV	1506	1519	1504	1612	1528	1528	1528	1513		
WHSV	1.6	1.6	1.6	1.8	1.7	1.7	1.7	1.6		
Contact Time, sec.	19.2	19.0	19.2	17.9	18.9	18.9	18.9	19.1		
Material Balance, %	101	100	100	111	103	101	100	98		
CO Conv. %	29	29	28	29	29	28	27	26		
to HC %	97	99	97	95	99	91	95	95		
H ₂ Conv. %	81	72	72	70	70	69	65	65		
to HC %	62	60	64	58	60	60	57	60		
Total Conv. %	32	28	27	32	32	31	29	28		
GHC/m ³ CO	172	174	183	174	181	160	158	154		
HC Selectivity, %										
C ₁	11	26	32	28	30	30	27	32		
C ₂	16	15	14	12	14	16	16	16		
C ₃	11	6	6	6	6	7	7	7		
C ₄	26	21	20	19	18	18	18	17		
C ₅ ⁺	13	12	8	9	9	8	10	5		
C ₅ Olefin Selectivity, %	23	20	20	26	23	21	22	23		
C ₂	2	2	13	2	14	14	14	14		
C ₃	2	4	4	4	4	4	4	4		
C ₄	9	9	10	1	12	1	1	1		
C ₅	NA	9	10	10	9	9	9	9		
C ₅ Olefin Selectivity, %	NA	2	1	1	1	1	1	1		
1-pentene	↓	17	17	17	17	17	17	17		
2-pentene		81	82	82	82	82	82	82		
Methylaromatics	47	45	52	55	56	45	52	52		
C ₆ ⁺ Aromatics, %	NA	347	340	357	347	324	326	336		
90% OH, °F										

a. Followed by activation in H₂ 16 hrs @ 950°F

b. Sixteen hours at 600°F

TABLE C12

AGING AND REGENERATION STUDY WITH CATALYST SG-B-2

(H₂/CO; 200 psig; 0.7 WHSV)

Run	CT-158	102-3	102-4	102-5	102-6	102-7	102-8	102-9
Days on Stream	5.8	7.8	9.8	11.8	14.0	15.8	18.0	
Temp., Inlet, °F	473	473	475	475	474	474	476	
Avg. °F	470	470	472	472	472	472	473	
Max. °F	485	485	486	484	484	483	484	
Outlet °F	460	460	461	460	462	461	463	
GHSV	720	720	720	675	657	677	760	
Contact Time, sec.	41.3	41.3	41.3	44.2	45.6	44.2	39.2	
Material Balance, %	100	98	100	98	101	95	100	
CO Conv. % wt.	35	33	36	33	32	30	30	
to HC % wt.	99	100	99	99	99	99	99	
H ₂ Conv. % wt.	68	64	67	63	59	62	61	
to HC % wt.	51	49	49	49	48	54	56	
Total Conv. % wt.	37	35	38	35	34	33	32	
G HC/m ³ CO	201	192	207	183	182	172	175	
HC Selectivity, % wt.	15	15	15	16	16	18	18	
C1	2	1	2	2	2	2	2	
C2	3	2	1	3	3	2	3	
C3	8	8	7	9	10	8	11	
C4	13	14	14	14	14	15	14	
C5+	59	60	61	56	55	55	52	
Olefin Selectivity, % wt.	5	33	26	33	33	33	32	
C2	42	24	47	49	40	48	40	
C3	67	67	68	67	71	69	73	
C4	76	80	80	81	82	82	82	
C5								
C ₅ Olefin Selectivity, % wt.	2	2	2	2	2	2	2	
1-pentene	16	16	16	16	16	16	16	
2-pentene	82	82	82	82	82	82	82	
Methylbutenes	8	8	8	8	1	5	6	
C ₆ + Aromatics, % wt.	396	376	362	376	380	381	371	
90 % OH, °F								
Octane Number (R+O)		89			89		89	

TABLE C12 (Continued)

AGING AND REGENERATION STUDY WITH CATALYST SG-B-2

(H₂/CO; 200 psig; 0.7 WHSV)

	10	11	12	13	14	15	16	17	18	19
Run CT-158-102- Days on Stream	20.8	22.6	24.8	2.1	3.9	6.0	7.8	1.8	3.1	2.0
Temp., Inlet °F	492	492	494	476	477	480	480	480	484	483
Avg. °F	491	490	492	475	475	477	478	479	481	481
Max. °F	506	503	505	485	484	485	486	482	486	485
Outlet°F	480	479	481	485	484	485	486	468	475	474
GHSV	851	824	766	847	791	824	751	789	781	783
WHSV	0.8	0.8	0.8	0.8	0.7	0.8	0.7	0.8	0.8	0.7
Contact Time, Sec.	35.0	36.2	38.9	35.2	37.7	36.2	39.7	37.7	38.1	38.1
Material Balance, %	105	100	98	102	104	101	99	96	98	100
CO Conversion, %	31	33	33	30	27	25	27	18	18	25
to HC %	99	99	99	99	99	99	99	99	99	99
H ₂ Conversion, %	88	72	75	61	58	54	58	39	37	47
to HC %	65	59	61	53	54	55	53	51	51	48
Total Conv., %	35	36	36	32	27	27	29	20	20	26
G HC/m ³ CO	181	198	190	168	151	146	151	93	96	127
HC Selectivity, %	12	24	24	15	17	19	19	19	20	16
C ₁	2	3	2	2	1	2	1	2	2	2
C ₂	2	3	3	3	4	3	3	5	6	4
C ₃	9	8	7	10	10	11	9	16	15	19
C ₄	14	12	14	15	13	13	13	14	13	16
C ₅ ⁺	61	51	50	55	55	52	55	44	44	44
Olefin Selectivity, %	25	33	40	32	50	35	50	50	50	50
C ₂	25	33	48	32	50	48	39	24	19	2
C ₃	61	62	62	61	67	69	64	11	17	8
C ₄	76	77	77	73	79	80	80	17	23	10
C ₅ Olefin Selectivity, %	2	2	2	2	2	2	2	2	2	2
1-Pentene	16	16	17	16	16	16	16	15	15	16
2-Pentene	82	82	81	82	82	82	82	83	83	82
Methylbenzenes	6	7	5	8	7	7	7	16	17	13
C ₆ ⁺ Aromatics, %	366	356	367	394	392	377	380	347	347	331
90% OH, °F	89	-	90	89	-	-	-	-	-	-
O. N. (R+O)	-	-	-	-	-	-	-	-	-	-

TABLE C13

MATERIAL BALANCES FROM FIXED BED BENCH-SCALE UNIT WITH CATALYST SG-B-2

	GHSV = 330				GHSV = 650					
	15-2	15-3	15-4	15-5	15-6	15-7	15-8	15-9	15-10	15-11
RUN NUMBER 225-	4.0	6.0	7.3	8.4	10.1	12.2	14.0	15.2	16.2	17.1
RUN DAYS-ON-STREAM	4.0	6.0	7.3	8.4	10.1	12.2	14.0	15.2	16.2	17.1
CUM. DAYS-ON-STREAM	2.6	1.9	2.0	2.0	2.0	2.3	2.1	2.4	2.1	2.4
FRESH FEED H ₂ /CO RATIO	332	329	332	330	329	325	646	642	648	666
GHSV, HR ⁻¹	12.85	13.17	13.33	13.11	12.84	15.67	9.60	9.35	9.47	9.46
RECYCLE RATIO	300	300	300	300	300	300	300	300	300	300
REACT. PRESS., PSIG	430	425	424	424	425	424	423	423	424	425
REACT. INLET TEMP., °F	513	517	516	519	516	509	504	511	508	514
NON. REACT. TEMP., °F										
CONVERSIONS, MOL %										
H ₂	86.4	72.7	78.7	79.2	78.7	81.1	44.6	49.2	48.9	43.6
CO	92.6	72.0	67.3	68.2	65.3	75.6	40.4	39.6	34.8	42.6
H ₂ +CO	88.1	72.5	74.8	75.6	74.2	79.5	43.3	46.3	44.3	43.3
YIELDS, WT %										
HYDROGEN	2.1	3.4	2.7	2.7	2.7	2.7	7.4	7.4	6.7	8.4
WATER	52.5	39.1	37.1	37.7	35.5	41.6	21.0	22.0	19.8	23.6
CO	6.2	24.7	28.9	28.0	30.6	21.0	52.0	52.0	57.2	49.2
CO ₂	1.5	1.5	1.6	1.5	1.5	1.6	0.9	0.8	0.6	0.7
TOTAL HYDROCARBON	37.6	31.3	29.7	30.2	29.7	33.2	18.6	17.8	15.7	18.1
HC SELECTIVITY, WT %										
METHANE	37.9	28.1	29.2	30.8	28.5	37.2	43.4	39.6	38.1	40.8
ETHENE	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
ETHANE	4.5	2.2	2.5	2.6	2.7	3.6	3.8	4.0	3.5	4.0
PROPENE	0.0	0.0	0.1	0.0	0.0	0.2	0.2	0.2	0.2	0.2
PROPANE	8.9	7.3	6.9	6.7	6.2	6.3	5.3	5.4	4.8	5.0
BUTENES	0.0	0.1	0.2	0.2	0.3	0.3	0.6	0.7	1.0	0.8
I-BUTANE	6.5	7.5	7.0	6.7	6.3	5.7	4.2	4.3	3.9	3.6
N-BUTANE	6.1	6.9	6.4	6.2	5.7	5.3	4.9	5.0	4.5	4.5
TOTAL C ₄ -	64.0	52.3	52.4	53.3	49.6	58.3	62.4	59.3	56.2	59.1
C ₅ + PARAFFINS	15.5	22.4	21.9	20.9	21.9	18.5	16.9	18.7	18.8	17.7
OLEFINS	3.0	2.5	4.0	3.4	4.8	5.1	4.4	3.9	5.0	4.2
NAPHTHENES	2.1	3.1	3.0	2.9	3.1	2.5	1.8	2.3	2.7	1.8
AROMATICS	11.6	15.7	14.3	13.7	14.0	10.9	8.1	8.2	9.0	8.4
OTHERS	3.8	4.0	4.4	5.7	6.6	4.7	6.4	7.7	8.4	8.9
TOTAL C ₅ +	36.0	47.7	47.6	46.7	50.4	41.7	37.6	40.7	43.8	40.9
YIELDS, G/SCM CONV CO+H ₂										
TOTAL HC	177	208	190	188	190	183	196	166	164	177
C ₅ +	64	99	90	88	96	76	74	67	72	73
OLEFINS, WT % BY C NO.										
C ₂	0.0	3.0	2.9	2.9	3.2	1.9	3.7	4.0	5.8	4.2
C ₃	0.0	0.0	1.0	0.0	0.0	0.9	3.2	3.4	4.2	3.8
C ₄	0.3	1.0	1.2	1.4	2.4	1.3	6.1	6.9	11.0	9.1
C ₅	1.1	2.2	3.1	3.5	4.6	3.4	9.7	11.1	17.8	14.2
90 PCT OH, RAW PROD., °F	409	383	389	406	403	398	413	419	426	414
OCTANE NO. ON RAW PROD.										
R+Q	87.6	85.8	86.8	86.5	86.5	86.7	84.0	83.2	82.4	82.9
R+3	97.5	100.0	97.0	97.0	97.0	95.5	94.4	94.7	94.8	92.9
OXYGENATES, WT %	0.1	0.1	0.1	0.1	0.1	-	0.1	-	-	0.1

TABLE C13 (Continued)

MATERIAL BALANCES FROM FIXED BED BENCH-SCALE UNIT WITH CATALYST SG-B-2

	GHSV = 330									
	15-12	15-13	15-14	15-15	15-16	15-17	15-18	15-19	15-20	
RUN NUMBER 225-	19.1	20.1	21.1	22.1	23.1	24.1	25.1	27.1	31.4	
CUM. DAYS-ON-STREAM	19.1	20.1	21.1	22.1	23.1	24.1	25.1	27.1	31.4	
FRESH FEED H ₂ /CO RATIO	2.3	2.2	2.2	2.1	2.1	2.3	2.3	2.3	2.0	
GHSV, HR ⁻¹	330	330	332	329	336	340	344	334	336	
RECYCLE RATIO	16.58	15.32	13.79	13.08	12.23	12.04	11.29	11.50	10.88	
REACT. PRESS., PSIG	300	301	300	300	300	300	300	300	299	
REACT. INLET TEMP., °F	428	424	424	422	422	423	424	425	422	
NOM. REACT. TEMP., °F	520	515	527	517	524	531	527	530	571	
CONVERSIONS, MOL %										
H ₂	77.0	71.7	71.8	69.9	67.0	74.7	72.1	74.5	77.9	
CO	69.2	65.7	64.5	63.9	60.0	64.4	64.4	68.2	57.0	
H ₂ +CO	74.7	69.8	69.5	68.0	64.7	71.5	69.8	72.6	70.9	
YIELDS, WT %										
HYDROGEN	3.3	4.0	3.9	4.0	4.3	3.6	4.0	3.6	2.8	
WATER	37.4	36.2	34.6	33.9	34.1	37.9	37.7	35.4	28.3	
CO	26.6	29.7	30.8	31.4	35.0	30.8	30.7	27.4	38.0	
CO ₂	2.2	1.6	1.7	1.6	1.4	1.6	1.6	2.5	10.8	
TOTAL HYDROCARBON	30.5	28.5	29.0	29.1	25.1	26.1	26.0	30.9	20.1	
HC SELECTIVITY, WT %										
METHANE	44.9	43.3	45.1	46.2	41.2	40.8	41.7	45.6	61.7	
ETHENE	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	
ETHANE	3.9	3.7	3.7	3.7	3.7	3.9	3.9	3.8	4.5	
PROPENE	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
PROPANE	6.1	5.5	5.7	5.5	5.3	5.7	6.5	7.0	8.9	
BUTENES	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	
I-BUTANE	5.0	4.5	4.7	4.5	4.4	4.6	5.3	5.7	4.8	
N-BUTANE	4.9	4.9	4.9	4.8	4.9	4.9	5.5	5.2	4.0	
TOTAL C ₄ -	65.0	62.2	64.4	65.1	59.9	60.3	63.2	67.6	84.1	
C ₅ + PARAFFINS	15.5	16.8	15.7	15.8	17.6	16.9	17.0	15.0	7.5	
OLEFINS	2.4	3.3	3.0	2.7	3.5	3.4	3.1	2.1	1.5	
NAPHTHENES	2.0	1.7	2.1	2.1	2.3	2.2	2.2	2.1	0.6	
AROMATICS	9.3	10.8	7.9	8.7	9.1	10.1	8.9	8.4	4.6	
OTHERS	5.8	5.3	6.9	5.6	7.6	7.0	5.5	4.7	1.8	
TOTAL C ₅ +	35.0	37.8	35.6	34.9	40.1	39.7	36.8	32.4	15.9	
YIELDS, G/SCM CONV CO+H ₂										
TOTAL HC	179	182	188	195	180	161	163	187	135	
C ₅ +	63	69	67	68	72	64	60	60	21	
OLEFINS, WT % BY C NO.										
C ₂	1.9	2.2	2.2	2.2	2.4	2.3	2.1	2.0	0.0	
C ₃	1.2	1.5	1.4	1.5	1.8	1.5	2.1	1.1	1.4	
C ₄	1.2	1.7	1.6	1.9	2.3	2.0	1.4	1.1	0.0	
C ₅	3.4	4.4	4.3	4.8	5.8	5.3	4.0	3.3	12.6	
90 PCT OH, RAW PROD., °F	406	404	408	411	408	-	402	390	-	
OCTANE NO. ON RAW PROD.										
R+0	83.9	83.5	82.9	84.5	83.8	83.6	84.4	-	-	
R+3	93.9	93.6	93.9	93.8	94.5	93.8	93.4	-	-	
OXYGENATES, WT %	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	