
Cr+6 Oxide on silica
CrO2
O
O
Si
Si

FIG. 1

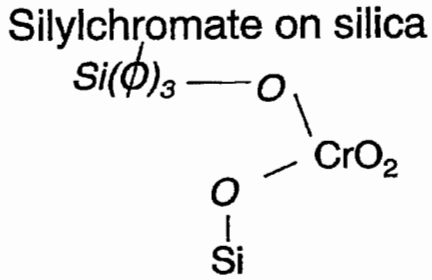

Silylchromate on silica
Si(ϕ)3
O
CrO2
O
Si

FIG. 2

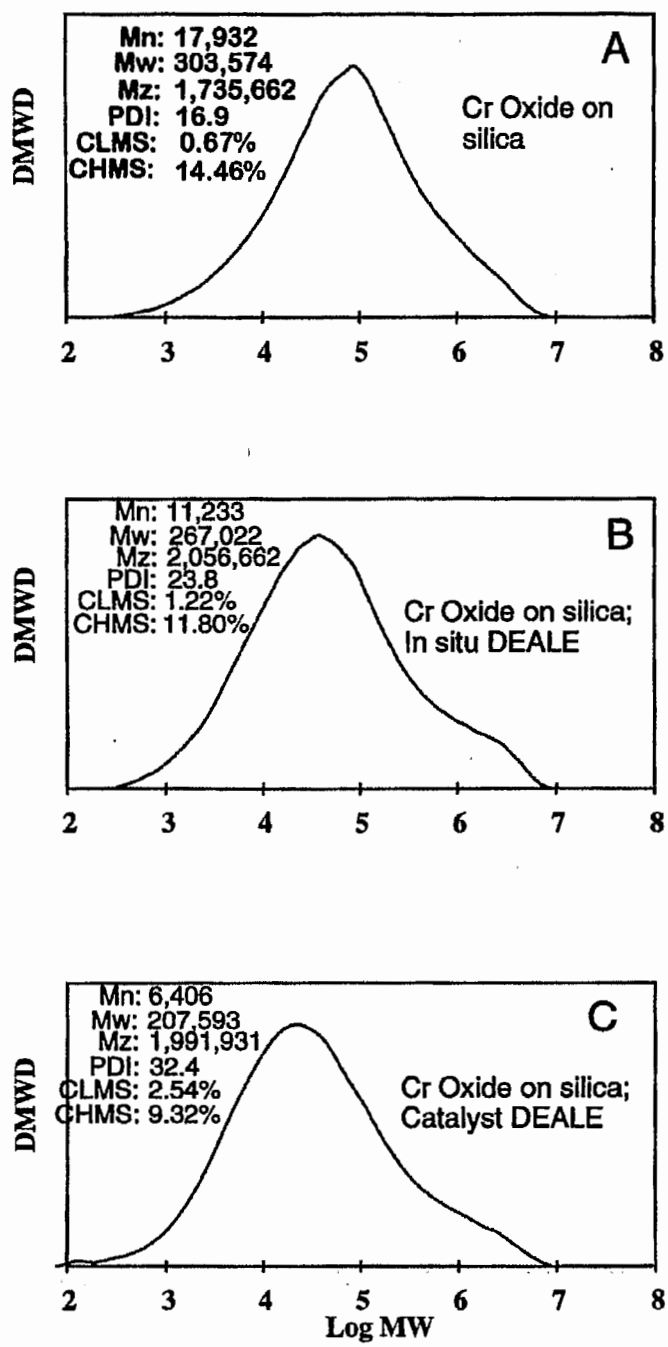

Mn: 17,932
Mw: 303,574
Mz: 1,735,662
PDI: 16.9
CLMS: 0.67%
CHMS: 14.46%
A
Cr Oxide on silica
DMWD
2 3 4 5 6 7 8
Mn: 11,233
Mw: 267,022
Mz: 2,056,662
PDI: 23.8
CLMS: 1.22%
CHMS: 11.80%
B
Cr Oxide on silica; In situ DEALE
DMWD
2 3 4 5 6 7 8
Mn: 6,406
Mw: 207,593
Mz: 1,991,931
PDI: 32.4
CLMS: 2.54%
CHMS: 9.32%
C
Cr Oxide on silica; Catalyst DEALE
DMWD
2 3 4 5 6 7 8
Log MW

FIG 3

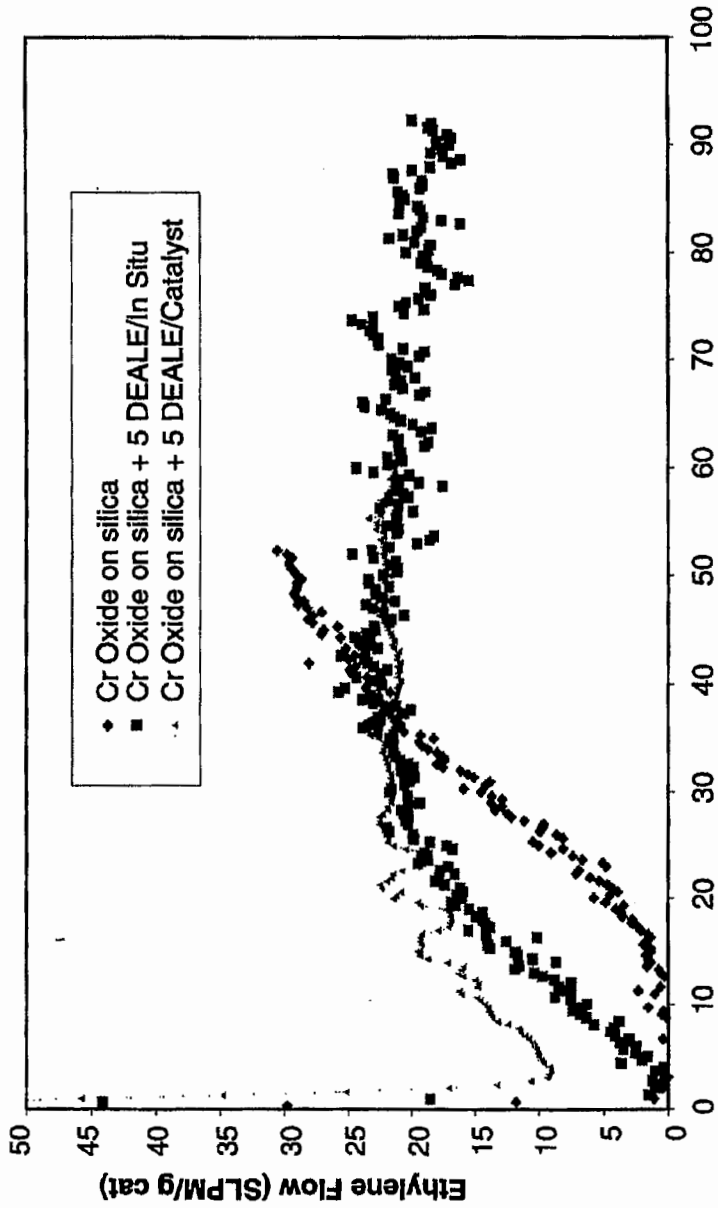

Cr Oxide on silica
Cr Oxide on silica + 5 DEALE/In Situ
Cr Oxide on silica + 5 DEALE/Catalyst
Ethylene Flow (SLPM/g cat)
Time (min)
0
5
10
15
20
25
30
35
40
45
50
0
10
20
30
40
50
60
70
80
90
100

FIG. 4

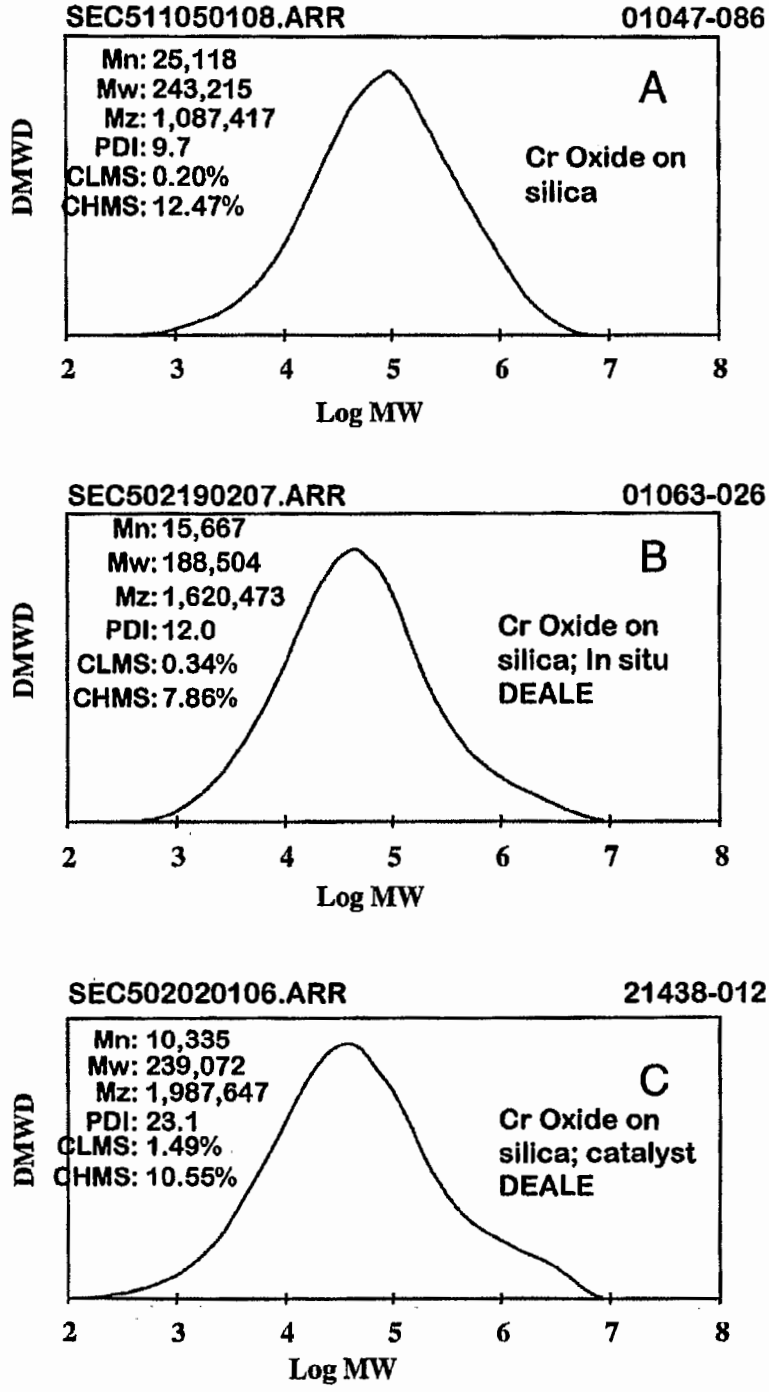

SEC511050108.ARR
01047-086
Mn: 25,118
Mw: 243,215
Mz: 1,087,417
PDI: 9.7
CLMS: 0.20%
CHMS: 12.47%
A
Cr Oxide on silica
DMWD
2 3 4 5 6 7 8
Log MW
SEC502190207.ARR
01063-026
Mn: 15,667
Mw: 188,504
Mz: 1,620,473
PDI: 12.0
CLMS: 0.34%
CHMS: 7.86%
B
Cr Oxide on silica; In situ DEALE
DMWD
2 3 4 5 6 7 8
Log MW
SEC502020106.ARR
21438-012
Mn: 10,335
Mw: 239,072
Mz: 1,987,647
PDI: 23.1
CLMS: 1.49%
CHMS: 10.55%
C
Cr Oxide on silica; catalyst DEALE
DMWD
2 3 4 5 6 7 8
Log MW

FIG 5

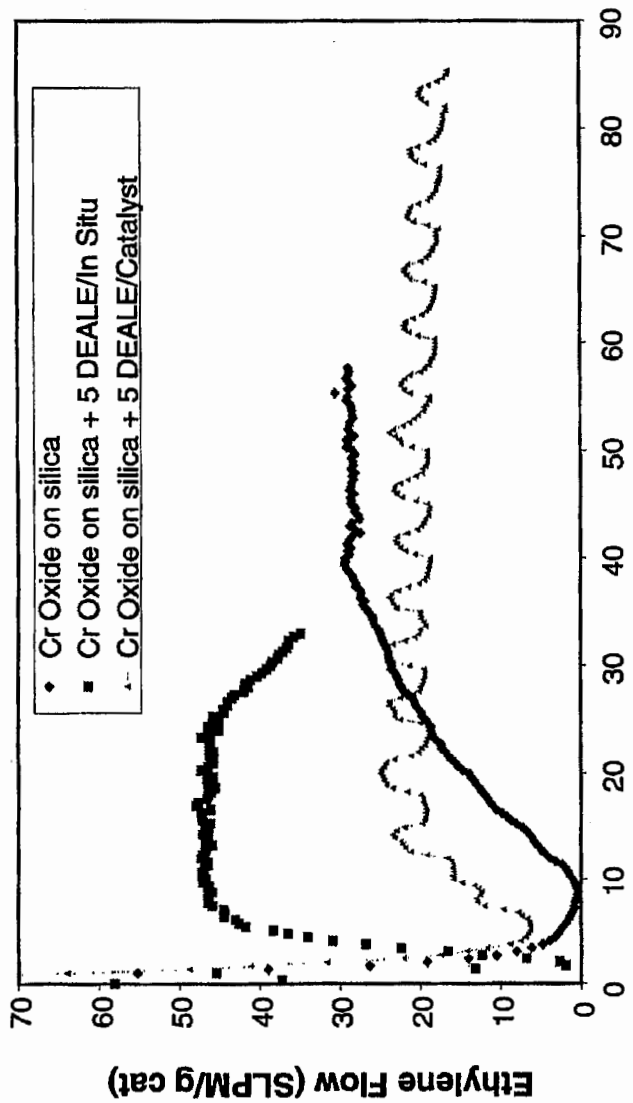

Cr Oxide on silica
Cr Oxide on silica + 5 DEALE/In Situ
Cr Oxide on silica + 5 DEALE/Catalyst
Ethylene Flow (SLPM/g cat)
Time (min)
0
10
20
30
40
50
60
70
80
90

FIG. 6

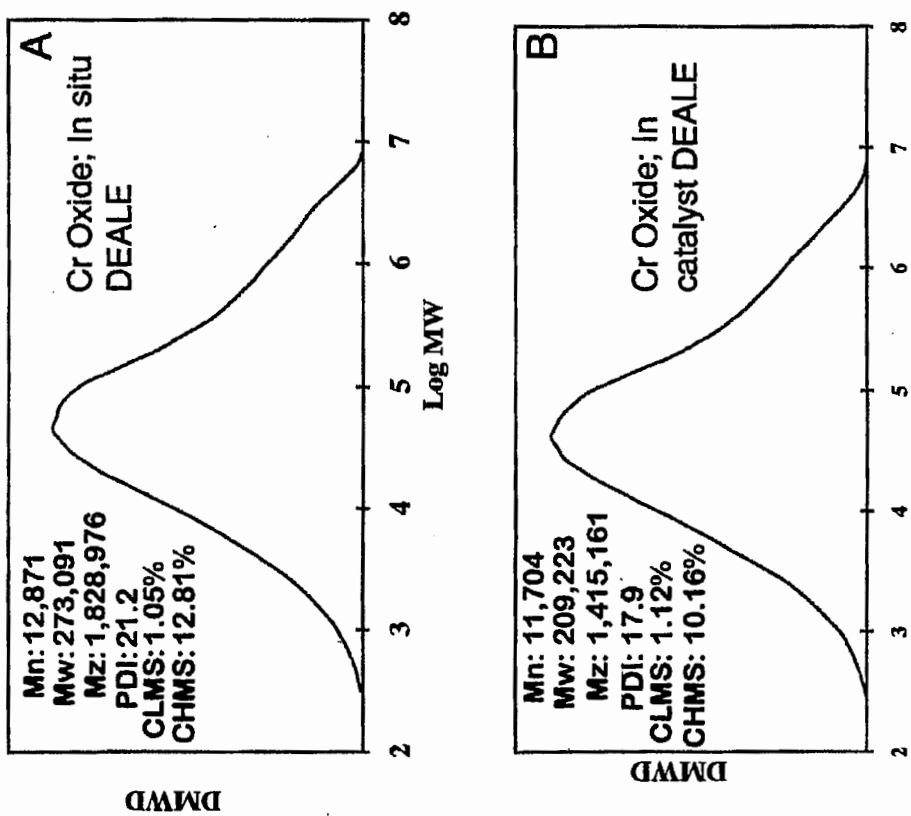

A
Cr Oxide; In situ
DEALE
Mn:12,871
Mw:273,091
Mz:1,828,976
PDI:21.2
CLMS:1.05%
CHMS:12.81%
DMWD
Log MW
2
3
4
5
6
7
8
B
Cr Oxide; In
catalyst DEALE
Mn: 11,704
Mw: 209,223
Mz: 1,415,161
PDI: 17.9
CLMS: 1.12%
CHMS: 10.16%
DMWD
Log MW

FIG. 7

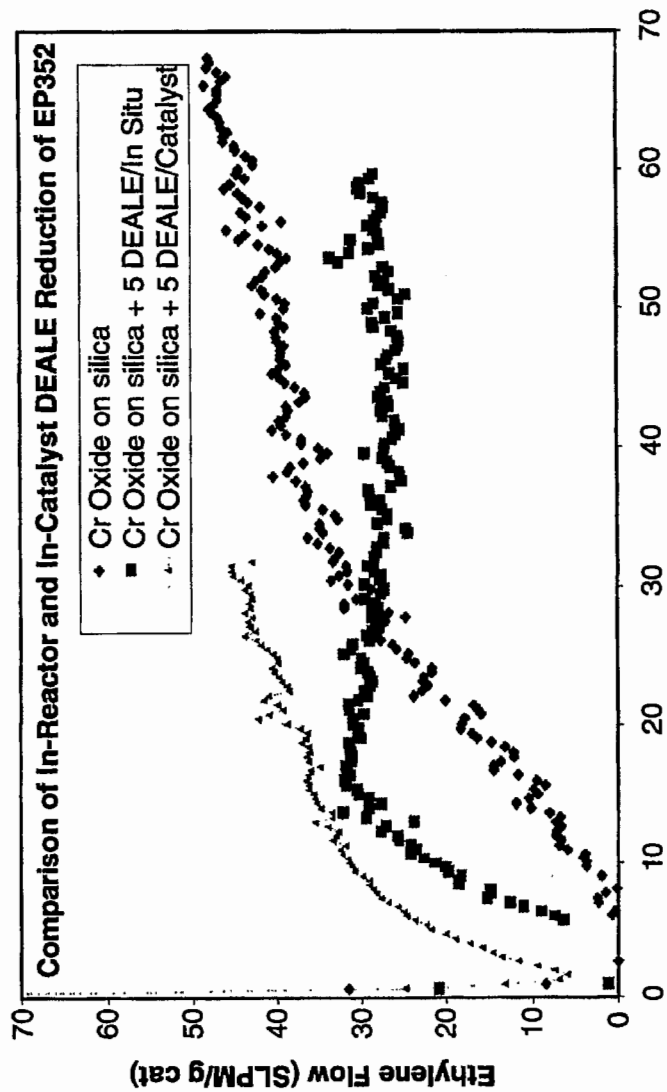

Comparison of In-Reactor and In-Catalyst DEALE Reduction of EP352
Cr Oxide on silica
Cr Oxide on silica + 5 DEALE/In Situ
Cr Oxide on silica + 5 DEALE/Catalyst
Ethylene Flow (SLPM/g cat)
Time (min)
0
10
20
30
40
50
60
70

FIG. 8

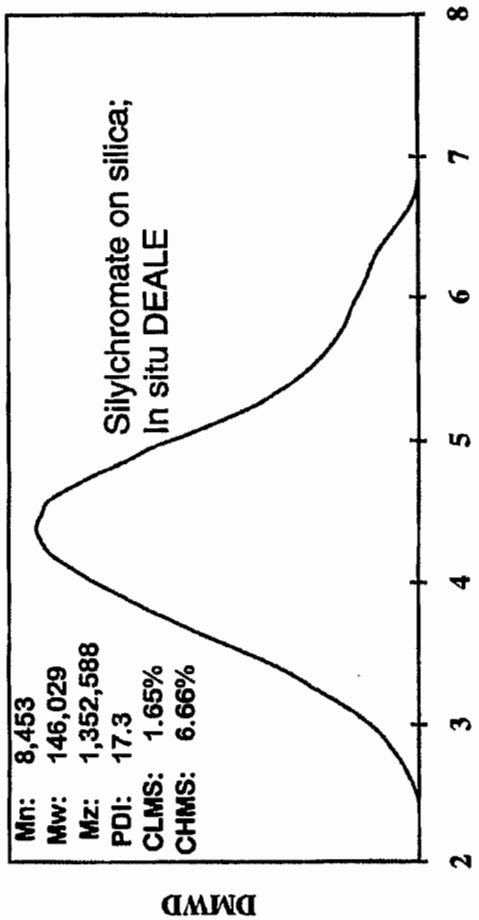

Mn: 8,453
Mw: 146,029
Mz: 1,352,588
PDI: 17.3
CLMS: 1.65%
CHMS: 6.66%
Silylchromate on silica;
In situ DEALE
DMWD
Log MW
2
3
4
5
6
7
8

FIG. 9

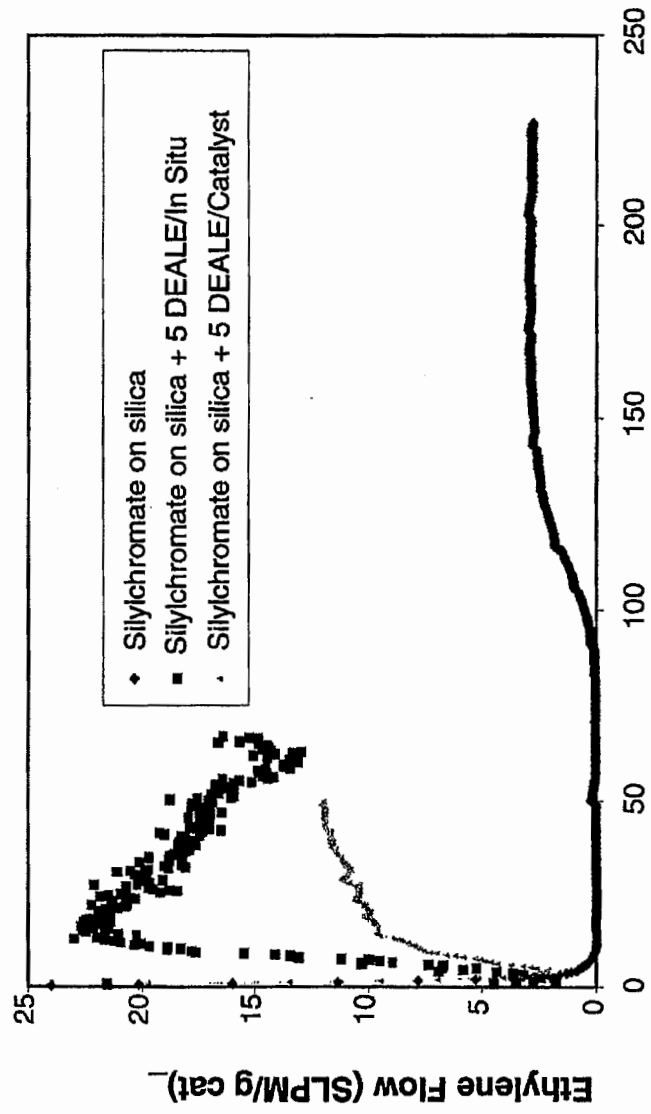

Silylchromate on silica
Silylchromate on silica + 5 DEALE/In Situ
Silylchromate on silica + 5 DEALE/Catalyst
Ethylene Flow (SLPM/g cat)
Time (min)
0
5
10
15
20
25
0
50
100
150
200
250

FIG. 10

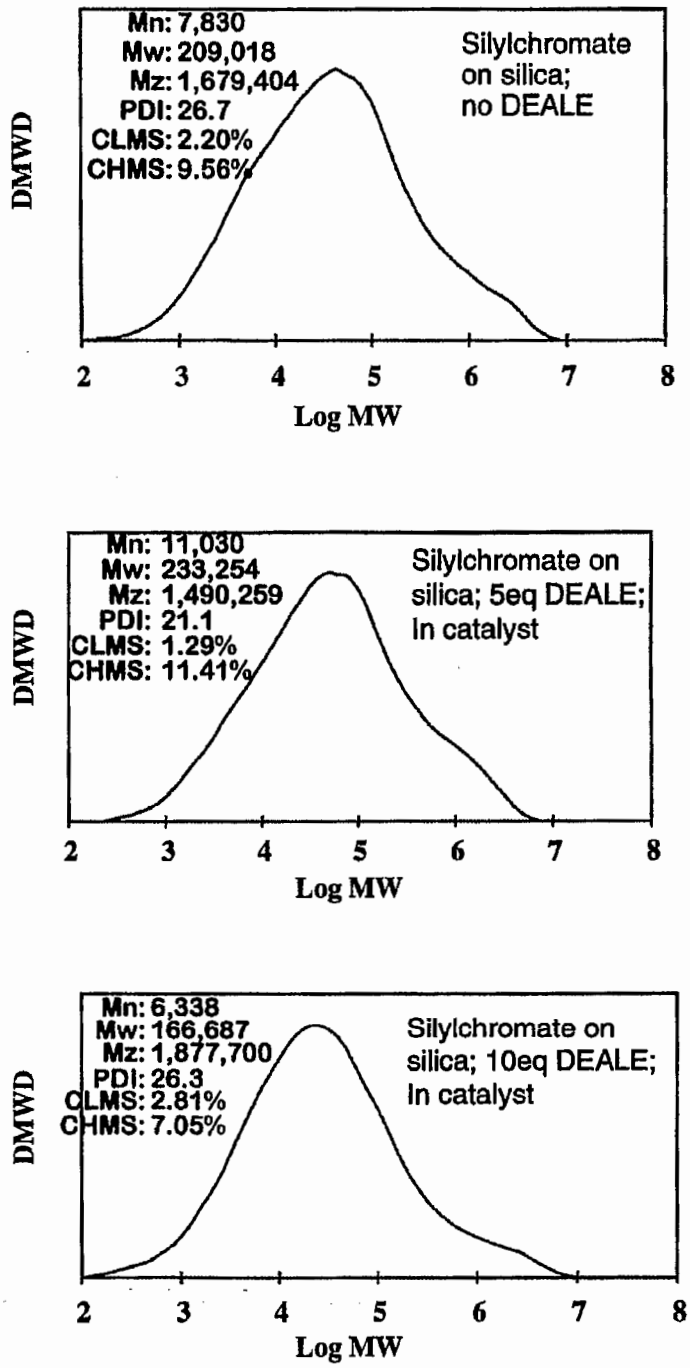

Mn: 7,830
Mw: 209,018
Mz: 1,679,404
PDI: 26.7
CLMS: 2.20%
CHMS: 9.56%
Silylchromate on silica; no DEALE
DMWD
2 3 4 5 6 7 8
Log MW
Mn: 11,030
Mw: 233,254
Mz: 1,490,259
PDI: 21.1
CLMS: 1.29%
CHMS: 11.41%
Silylchromate on silica; 5eq DEALE; In catalyst
DMWD
2 3 4 5 6 7 8
Log MW
Mn: 6,338
Mw: 166,687
Mz: 1,877,700
PDI: 26.3
CLMS: 2.81%
CHMS: 7.05%
Silylchromate on silica; 10eq DEALE; In catalyst
DMWD
2 3 4 5 6 7 8
Log MW

FIG. 11

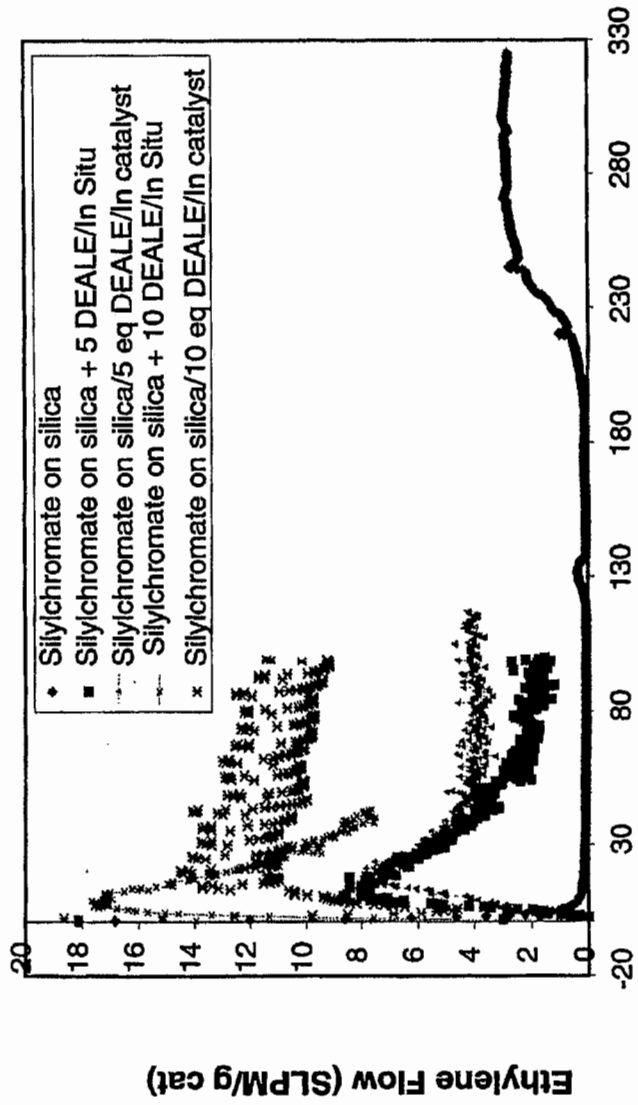

Silylchromate on silica
Silylchromate on silica + 5 DEALE/In Situ
Silylchromate on silica/5 eq DEALE/In catalyst
Silylchromate on silica + 10 DEALE/In Situ
Silylchromate on silica/10 eq DEALE/In catalyst
Ethylene Flow (SLPM/g cat)
Time (min)
20
18
16
14
12
10
8
6
4
2
0
-20
30
80
130
180
230
280
330

FIG. 12

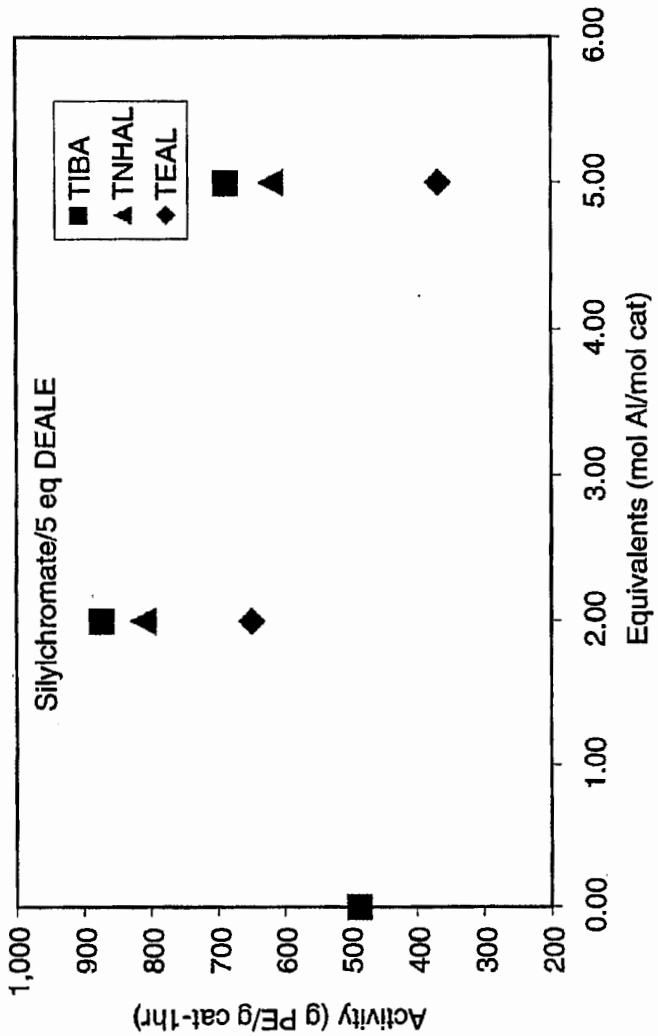

Silylchromate/5 eq DEALE
TIBA
TNHAL
TEAL
Activity (g PE/g cat-1hr)
1,000
900
800
700
600
500
400
300
200
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Equivalents (mol Al/mol cat)

FIG. 13

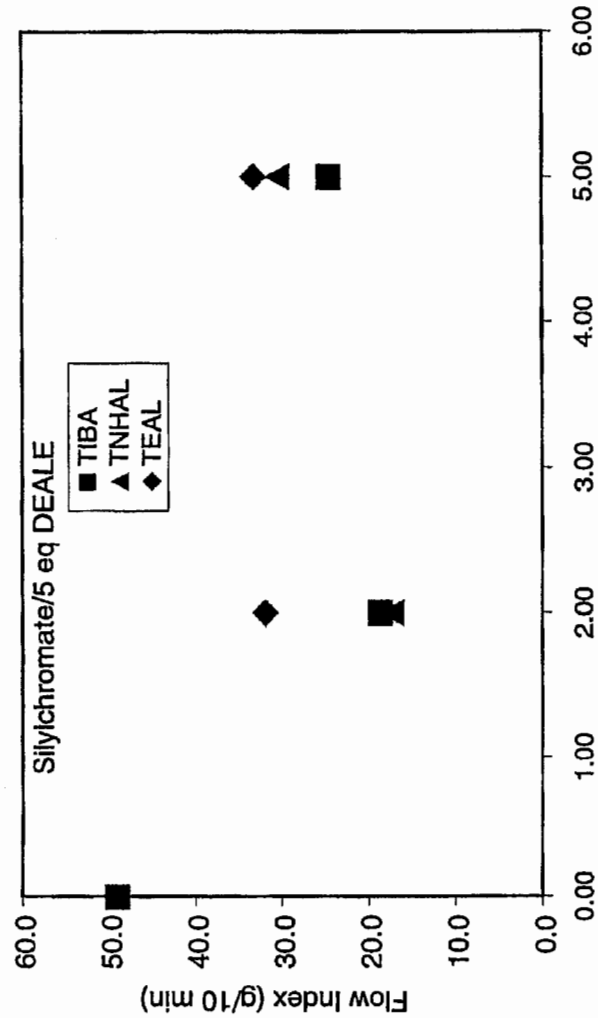

Silylchromate/5 eq DEALE
TIBA
TNHAL
TEAL
Flow Index (g/10 min)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Equivalents (mol Al/mol cat)

FIG. 14

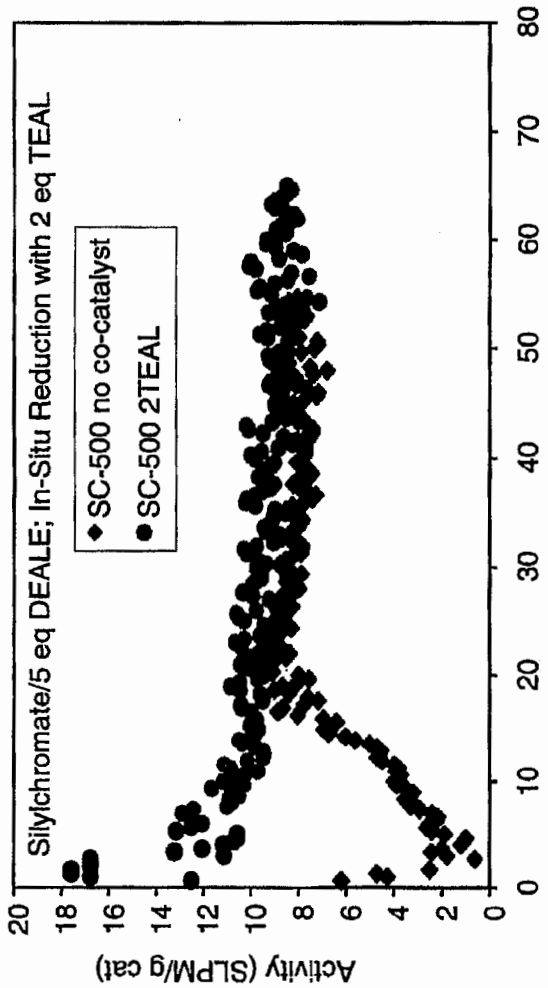

Silylchromate/5 eq DEALE; In-Situ Reduction with 2 eq TEAL
SC-500 no co-catalyst
SC-500 2TEAL
Activity (SLPM/g cat)
Time (min)
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80

FIG. 15

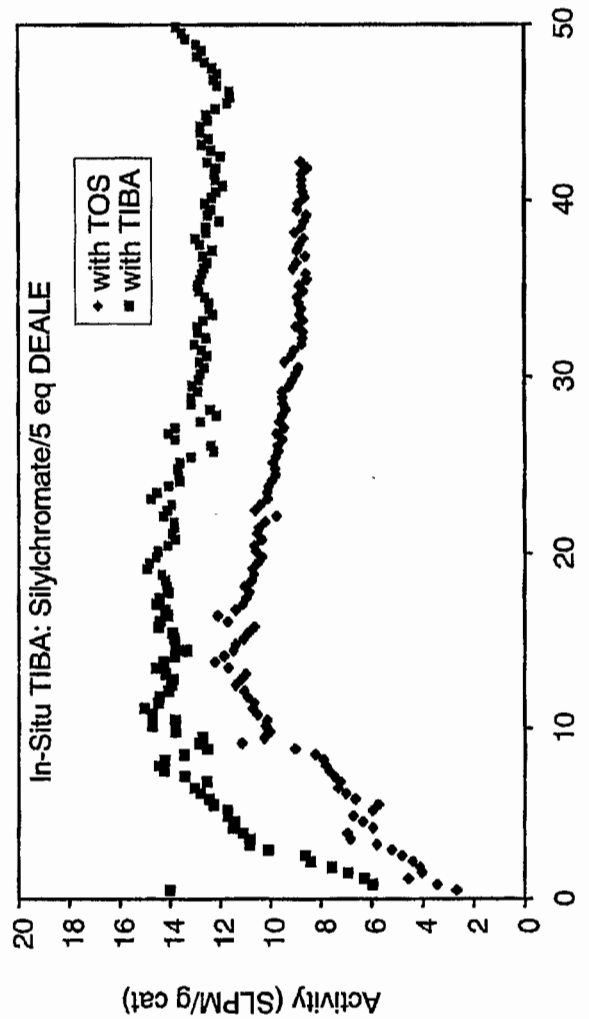

In-Situ TIBA: Silylchromate/5 eq DEALE
with TOS
with TIBA
Activity (SLPM/g cat)
Time (min)
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50

FIG. 16

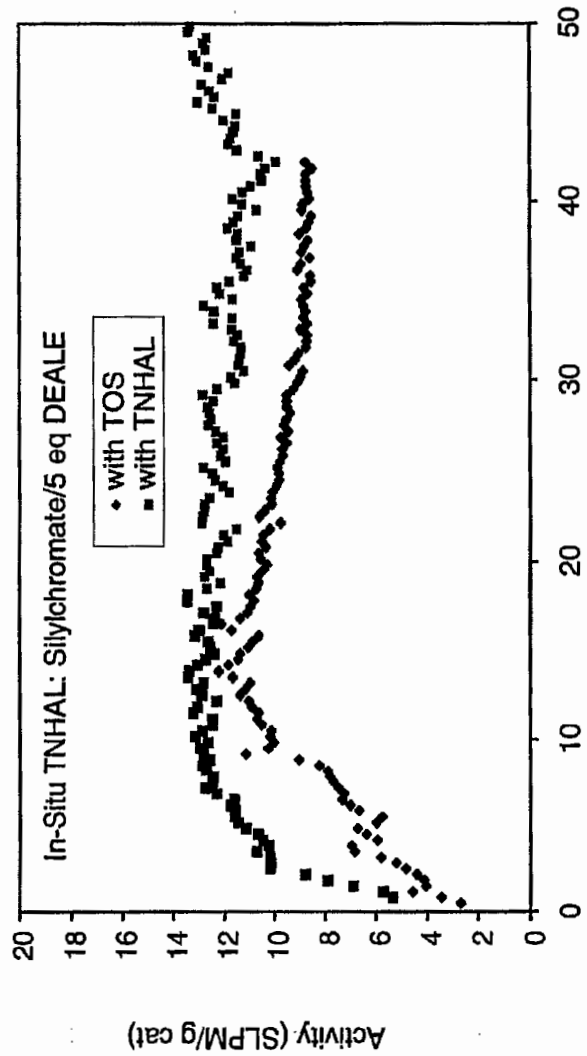

In-Situ TNHAL: Silylchromate/5 eq DEALE
with TOS
with TNHAL
Activity (SLPM/g cat)
Time (min)
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50

FIG. 17

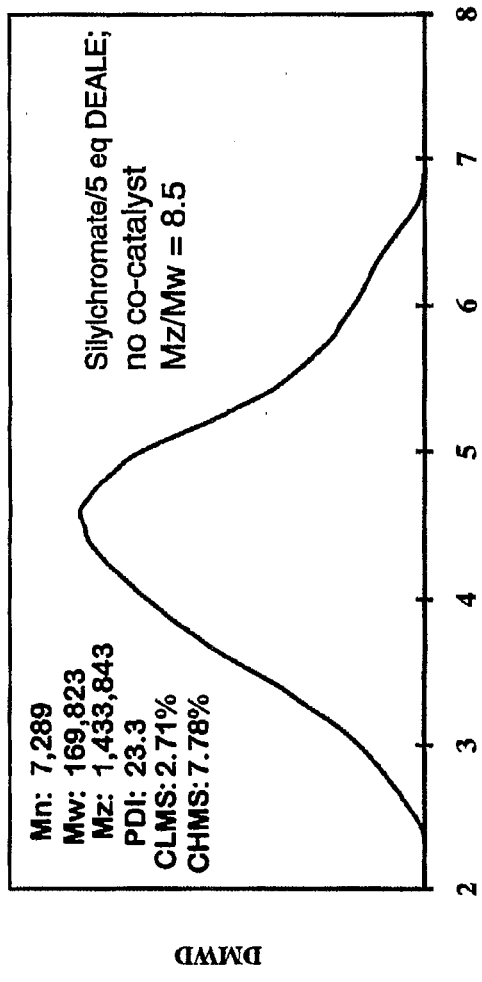

Mn: 7,289
Mw: 169,823
Mz: 1,433,843
PDI: 23.3
CLMS: 2.71%
CHMS: 7.78%
Silylchromate/5 eq DEALE;
no co-catalyst
Mz/Mw = 8.5
DMWD
2
3
4
5
6
7
8
Log MW

FIG. 18

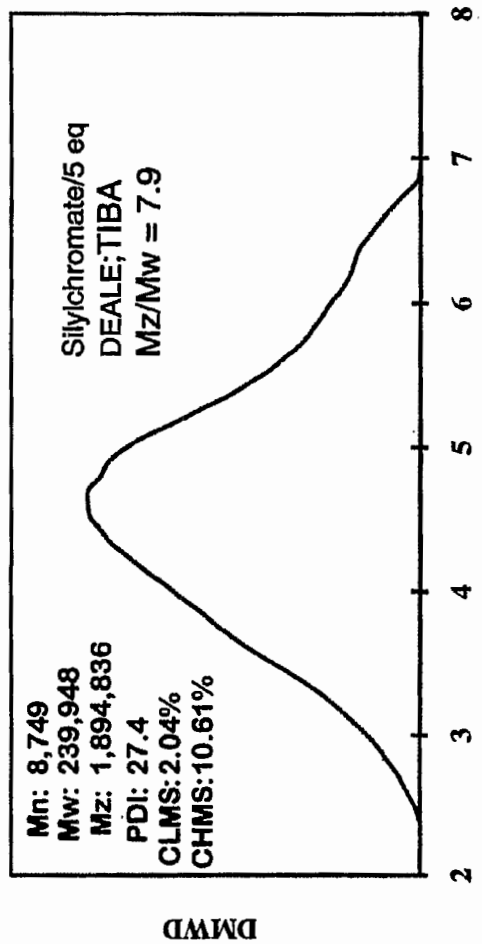

Mn: 8,749
Mw: 239,948
Mz: 1,894,836
PDI: 27.4
CLMS: 2.04%
CHMS: 10.61%
Silylchromate/5 eq
DEALE;TIBA
Mz/Mw = 7.9
DMWD
Log MW
2
3
4
5
6
7
8

FIG. 19

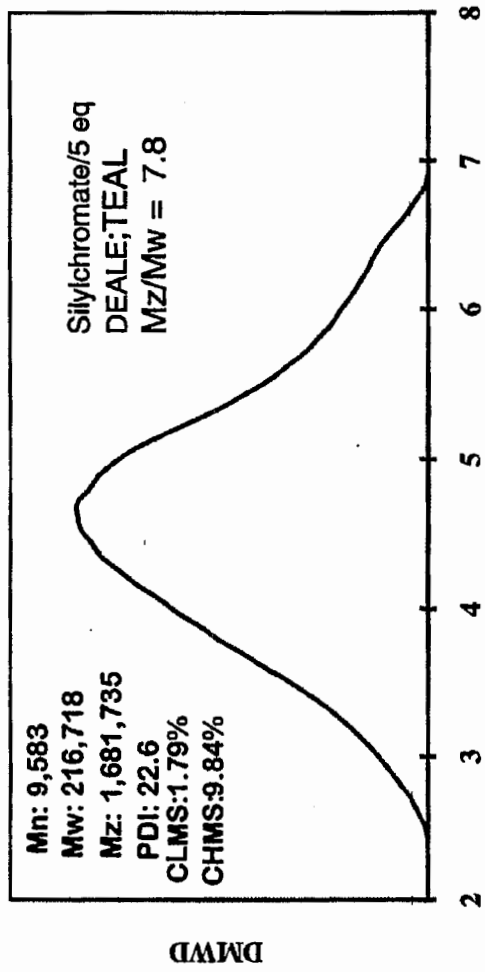

Mn: 9,583
Mw: 216,718
Mz: 1,681,735
PDI: 22.6
CLMS:1.79%
CHMS:9.84%
Silylchromate/5 eq
DEALE;TEAL
Mz/Mw = 7.8
DMWD
Log MW
2
3
4
5
6
7
8

FIG. 20

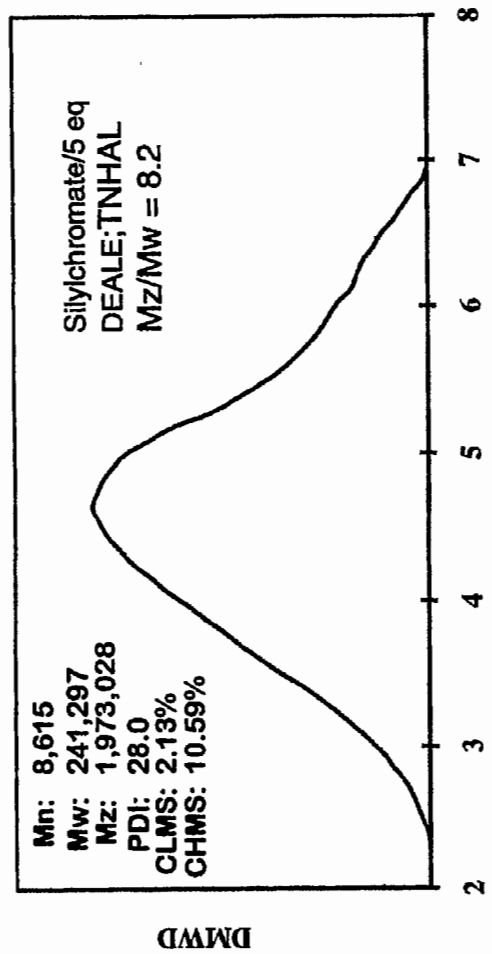

Silylchromate/5 eq
DEALE;TNHAL
Mz/Mw = 8.2
Mn: 8,615
Mw: 241,297
Mz: 1,973,028
PDI: 28.0
CLMS: 2.13%
CHMS: 10.59%
DMWD
Log MW
2
3
4
5
6
7
8

FIG. 21

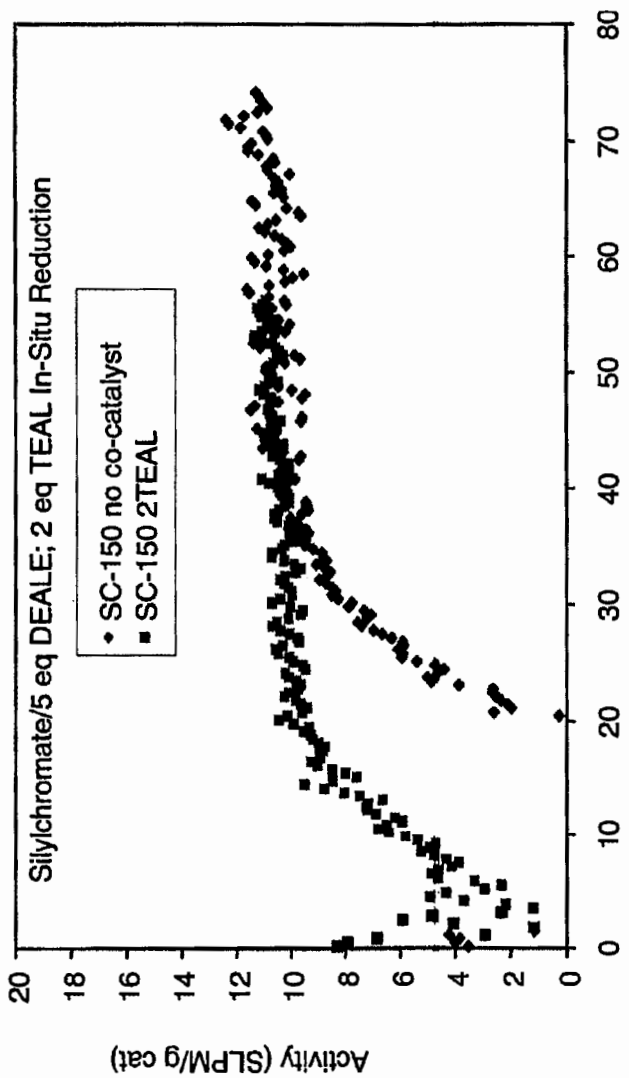

Silylchromate/5 eq DEALE; 2 eq TEAL In-Situ Reduction
SC-150 no co-catalyst
SC-150 2TEAL
Activity (SLPM/g cat)
Time (min)
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80

FIG. 22

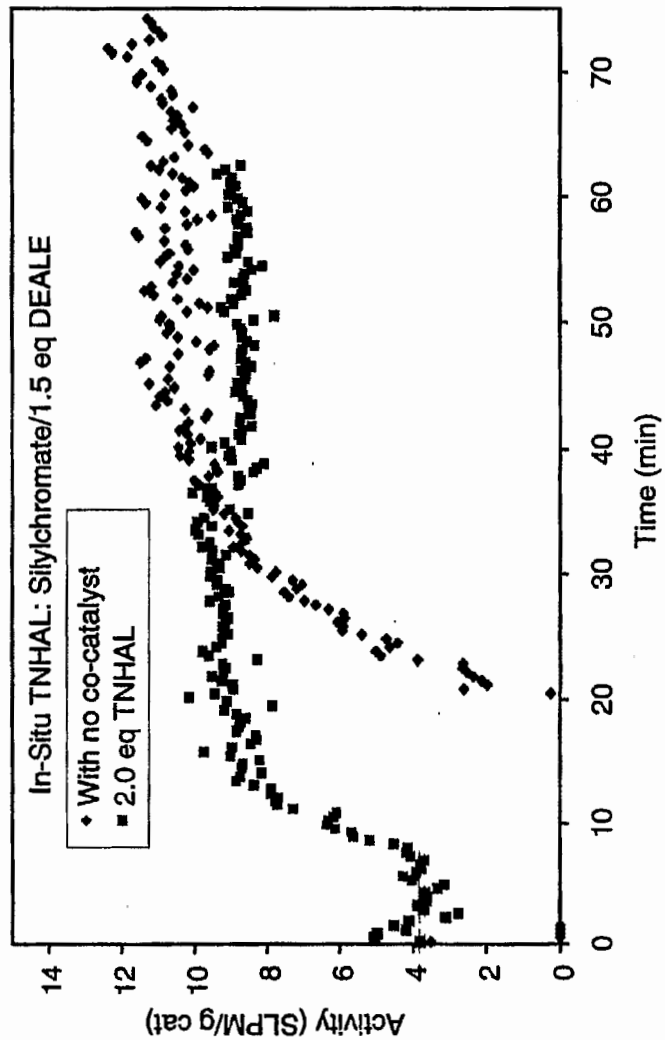

In-Situ TNHAL: Silylchromate/1.5 eq DEALE
With no co-catalyst
2.0 eq TNHAL
Activity (SLPM/g cat)
Time (min)
0
2
4
6
8
10
12
14
0
10
20
30
40
50
60
70

FIG. 23

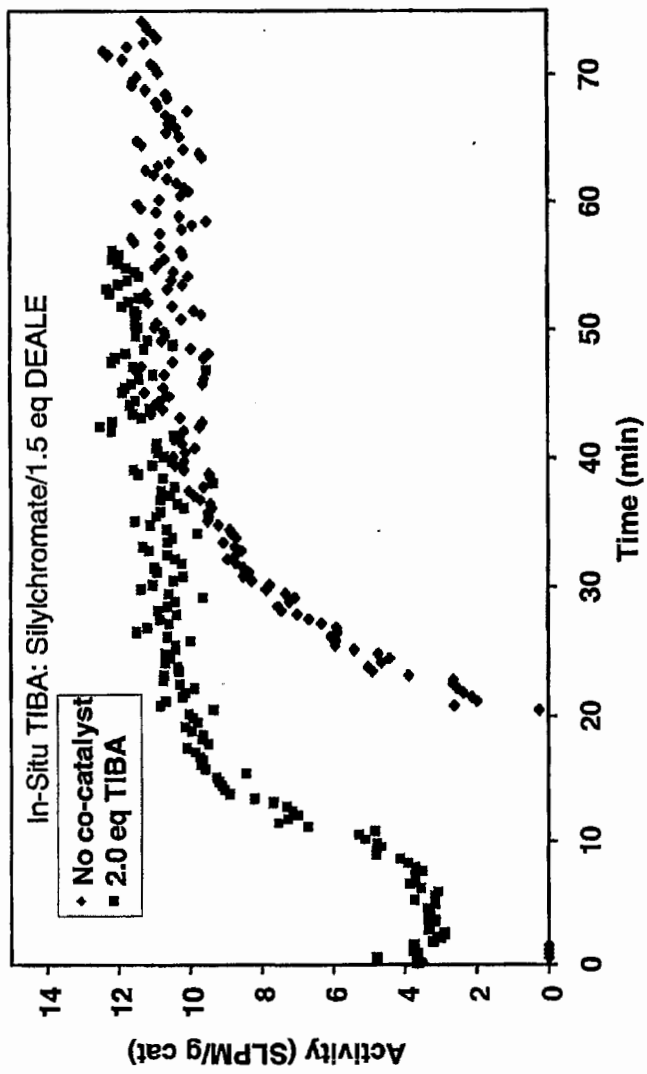

In-Situ TIBA: Silylchromate/1.5 eq DEALE
No co-catalyst
2.0 eq TIBA
Activity (SLPM/g cat)
Time (min)
0
2
4
6
8
10
12
14
0
10
20
30
40
50
60
70

FIG. 24

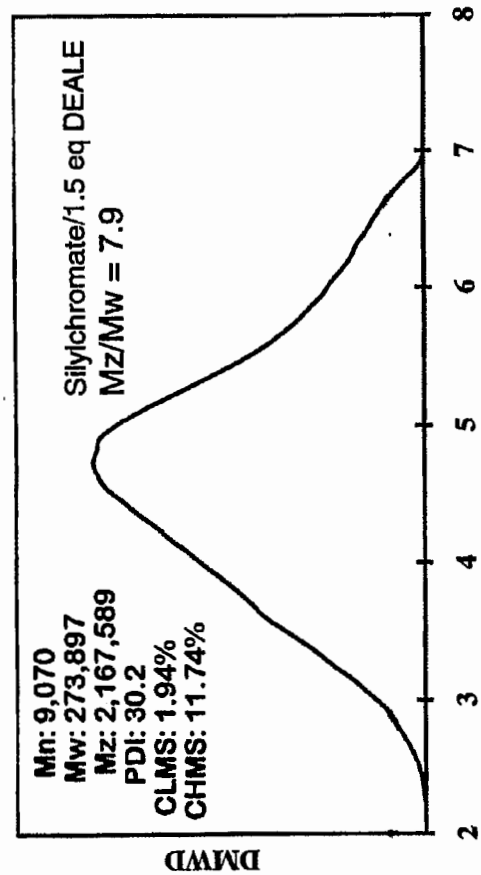

Silylchromate/1.5 eq DEALE
Mz/Mw = 7.9
Mn: 9,070
Mw: 273,897
Mz: 2,167,589
PDI: 30.2
CLMS: 1.94%
CHMS: 11.74%
DMWD
Log MW
2
3
4
5
6
7
8

FIG. 25

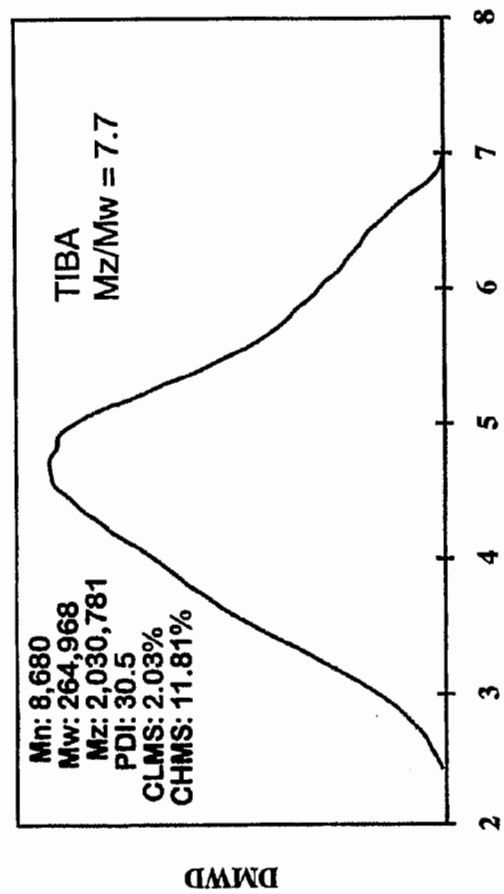

TIBA
Mz/Mw = 7.7
Mn: 8,680
Mw: 264,968
Mz: 2,030,781
PDI: 30.5
CLMS: 2.03%
CHMS: 11.81%
DMWD
Log MW
2
3
4
5
6
7
8

FIG. 26

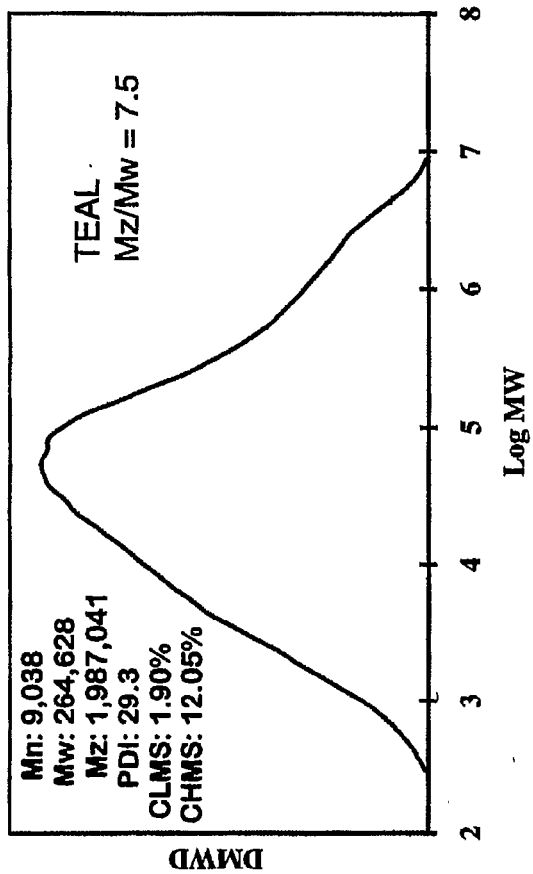

TEAL
Mz/Mw = 7.5
Mn: 9,038
Mw: 264,628
Mz: 1,987,041
PDI: 29.3
CLMS: 1.90%
CHMS: 12.05%
DMWD
Log MW
2
3
4
5
6
7
8

FIG. 27

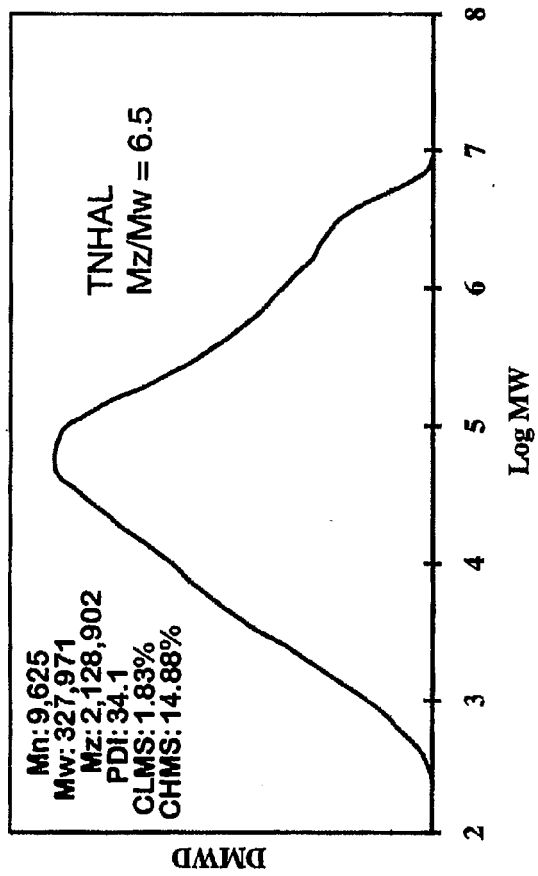

TNHAL
Mz/Mw = 6.5
Mn:9,625
Mw:327,971
Mz:2,128,902
PDI:34.1
CLMS:1.83%
CHMS:14.88%
DMWD
Log MW
2
3
4
5
6
7
8

FIG. 28

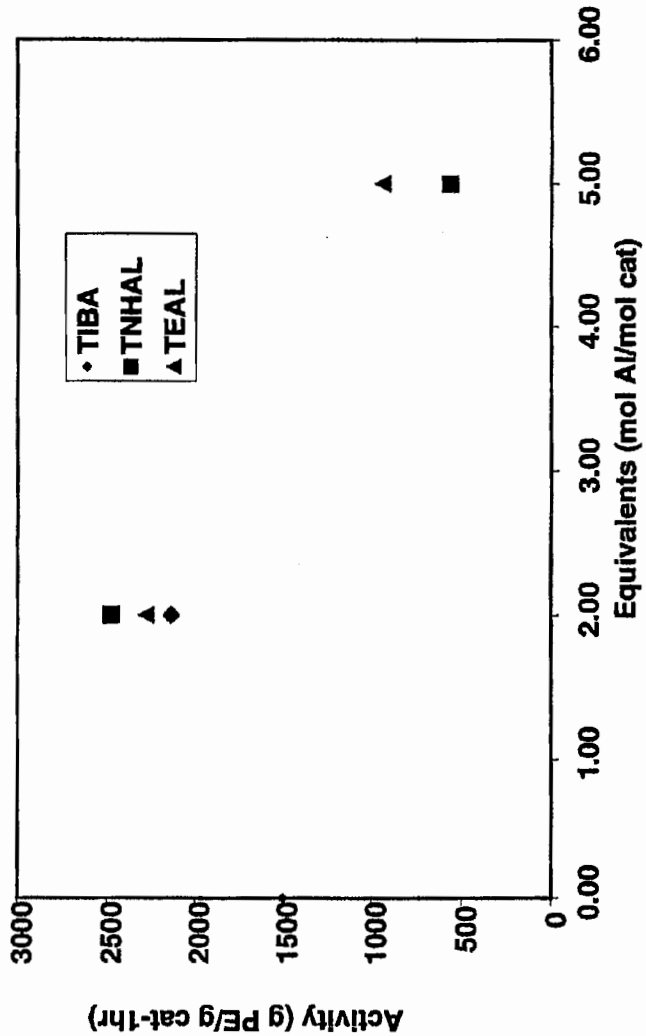

Activity (g PE/g cat-1hr)
3000
2500
2000
1500
1000
500
0
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Equivalents (mol Al/mol cat)
TIBA
TNHAL
TEAL

FIG. 29

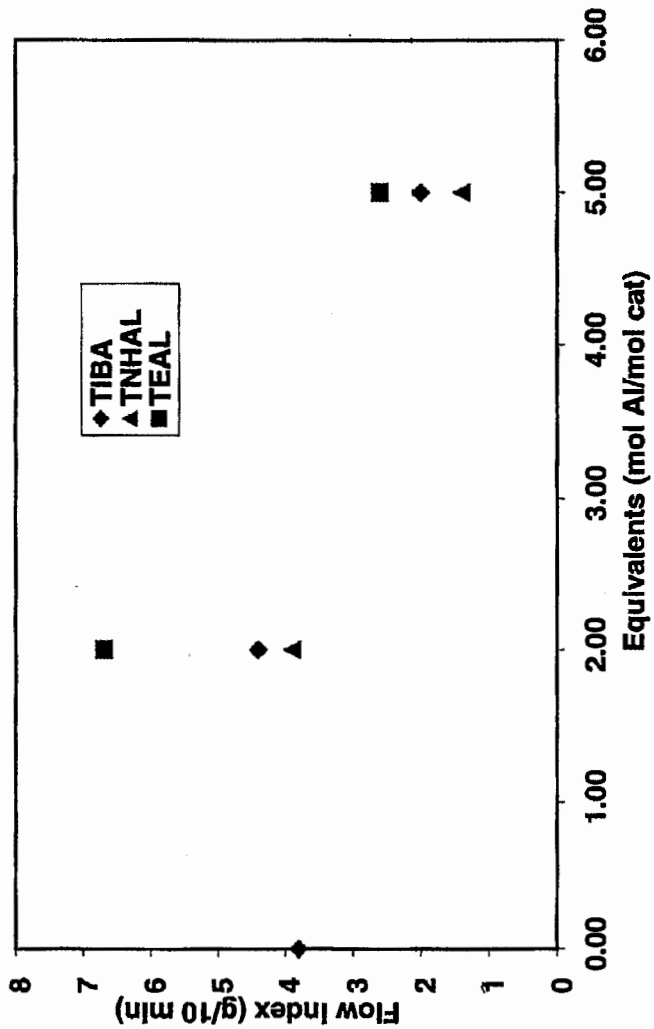

TIBA
TNHAL
TEAL
Flow Index (g/10 min)
0
1
2
3
4
5
7
8
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Equivalents (mol Al/mol cat)

FIG. 30

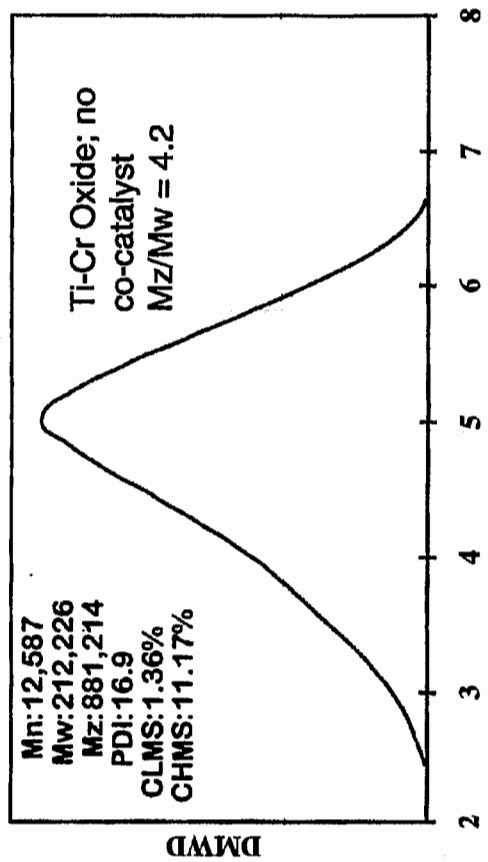

Mn:12,587
Mw:212,226
Mz:881,214
PDI:16.9
CLMS:1.36%
CHMS:11.17%
Ti-Cr Oxide; no co-catalyst
Mz/Mw = 4.2
DMWD
Log MW
2
3
4
5
6
7
8

FIG. 31

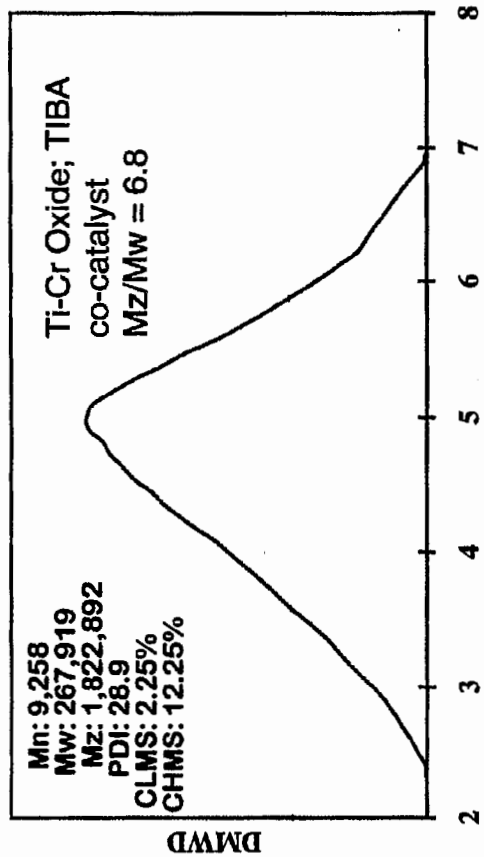

Ti-Cr Oxide; TIBA
co-catalyst
Mz/Mw = 6.8
Mn: 9,258
Mw: 267,919
Mz: 1,822,892
PDI: 28.9
CLMS: 2.25%
CHMS: 12.25%
DMWD
Log MW
2
3
4
5
6
7
8

FIG. 32

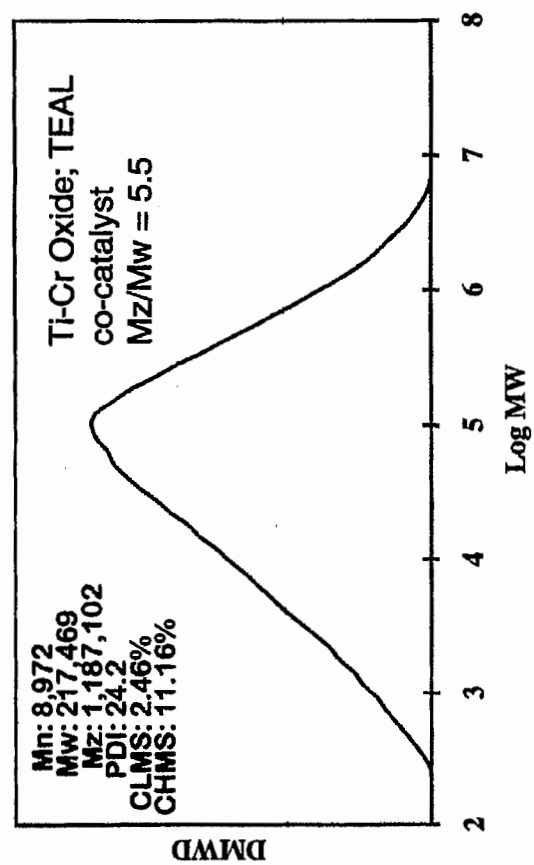

Ti-Cr Oxide; TEAL
co-catalyst
Mz/Mw = 5.5
Mn: 8,972
Mw: 217,469
Mz: 1,187,102
PDI: 24.2
CLMS: 2.46%
CHMS: 11.16%
DMWD
Log MW
2
3
4
5
6
7
8

FIG. 33

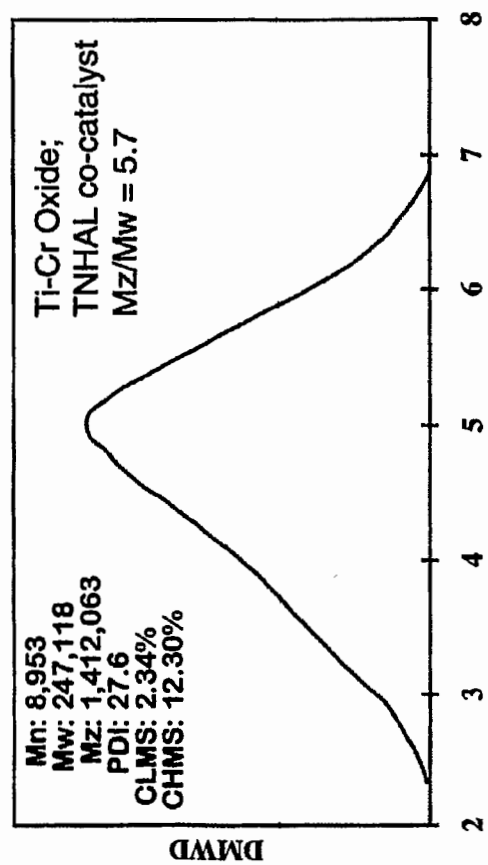

Ti-Cr Oxide;
TNHAL co-catalyst
Mz/Mw = 5.7
Mn: 8,953
Mw: 247,118
Mz: 1,412,063
PDI: 27.6
CLMS: 2.34%
CHMS: 12.30%
DMWD
Log MW
2
3
4
5
6
7
8

FIG. 34

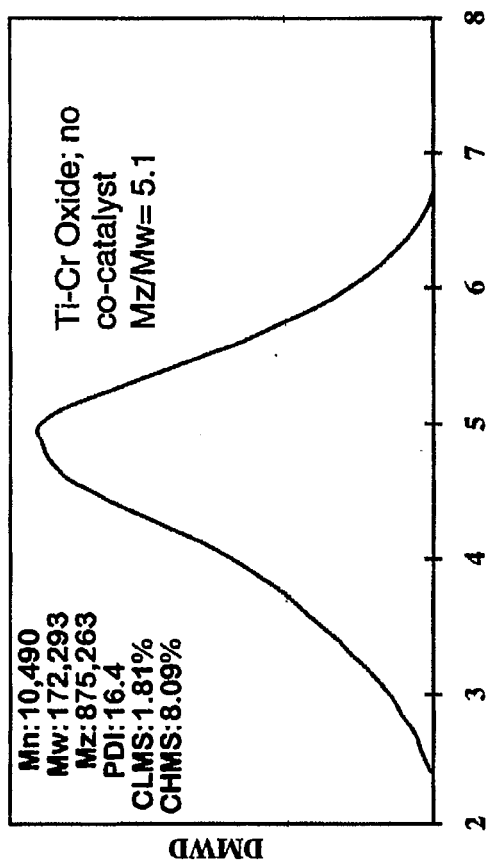

Ti-Cr Oxide; no co-catalyst
Mz/Mw= 5.1
Mn:10,490
Mw:172,293
Mz:875,263
PDI:16.4
CLMS:1.81%
CHMS:8.09%
DMWD
Log MW
2
3
4
5
6
7
8

FIG. 35

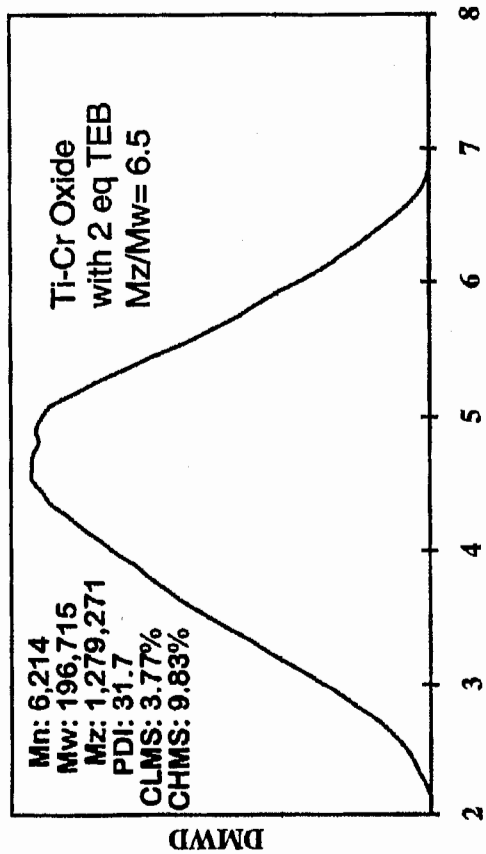

Ti-Cr Oxide
with 2 eq TEB
Mz/Mw= 6.5
Mn: 6,214
Mw: 196,715
Mz: 1,279,271
PDI: 31.7
CLMS: 3.77%
CHMS: 9.83%
DMWD
Log MW
2
3
4
5
6
7
8

FIG. 36