	(19) (12)	(KR) (A)	
(51) 。Int. CI. ⁷ C08F 4/645		(11) (43)	2001 - 0089625 2001 10 06
(21) (22)	10 - 2001 - 7009384 2001 07 26 2001 07 26		
(86) (86)	PCT/JP2000/00229 2000 01 19	(87) (87)	WO 2000/44793 2000 08 03
(81)	: , , EP : ,	, , 가 , , , , , ,	, , , , ,
(30)	JP - P - 1999 - 0002 2075 JP - P - 1999 - 0014 1999 6305 1999	01 29 (JP) 05 26 (JP)	
(71)	가가 가 가 가	가 5 6 1	
(72)	299 - 0107	1 - 1	
	299 - 0107	1 - 1	
(74)	299 - 0107	1 - 1	
:			
(54)			

(A) , (B) , , (C) (D)

가 가 가 93 - 301917 , 94 - 136047 , 89 - 009206). 97 - 164510 , (syndiotactic)

, , , , 2가 . 1

1. (A) ,

(B) ,

(C) I-1 :

 $\frac{I-1}{((R^I)_3-C-Y)n-Z-(R^2)m-n}$

```
(
R^1
               30
                                               30
          6
                                         1
                                                                       30
                                                                                 , R <sup>1</sup>
     30
                           6
                                 30
Y 16
Z 2
         13
R^2
                  가
        Z
m
n 1 (m-1)
                 ),
(D)
2.
                , Y가
                      Z가
      (C)
                                             1
                       (R^{1})_{3} - C - OR^{3}
                                                    Z(R^2)m
3.
      (C)
(
R^1
               30
                                               30
                                                                 6
                                                                       30
                                                                                    , R <sup>1</sup>
                           6 30
1
     30
                                  R^1
R^3
                                  30
                                                                  30
                                                1
     30
                             30
                                                       30
                                                                                  30
Z 2
      13
           Ζ
                가
m
R^2
                      ).
4. (A)
(B)
(C1) (R^{1})_{3} - C - OR^{3}
```

(

```
R^1
             6
                      30
                                                                  30
                                                                                            6
                                                                                                    30
                                                                                                                        , R <sup>1</sup>
1
        30
                                    6 30
                                                   R^1
R^3
                                         1
                                                 30
                                                                                     6
                                                                                             30
1
                                         30
                                                                             30
                                                                                                                    30
        30
                                 6
                                                                   1
                                                                                                            6
       Z(R^2)m
(C2)
     , Z 2 13
                Z 가
m
R^2
                               ),
(D)
5. 3
          R^1
                                              30
                                      6
                                                                                  1
6. 3
          R^1
                  가
                                     30
7. 3
          R^1
                  가
8. R<sup>2</sup>가
                 2
                                                    7
9. Z가
                          3 8
                             (A)가
10.
                                                     I - 2
                                                                I - 6
                                                                                                                   9
 1-2
Q^{I}_{a}(C_{5}\,H_{5\text{-a-b}}\,R^{8}_{\ b})(C_{5}\,H_{5\text{-a-c}}\,R^{9}_{\ c})M^{I}X^{I}Y^{1}
  1-3
{Q^2}_a\,(C_5\,H_{5\,\text{-}a\,\text{-}b}\quad {R^{10}}_d\,)Z^I\,M^I\,X^IY^I
      I - 4
(C_5 H_{5-e} R^{11}_e) M^I X^I Y^I W^1
      l - 5
```

I - 6

 $M^I X^I Y^I W^1 U^1$

```
L^{1} L^{2} M^{2} X^{I} Y^{I}
Q<sup>1</sup> 2 5 (C_5 H_{5-a-b} R_b^8) (C_5 H_{5-a-c} R_c^9) 가
Q^2 5 (C_5 H_{5-a-b} R^{10}_{d}) Z^1 7
R^8, R^9, R^{10} R^{11}
a O, 1 2 ;
b, c d a가 0
                                                                           a가 2
                 0 5 , a가 1 0 4
e 0 5 ;
M^2 8 10
L^{l} L^{2}
X^{1}, Y^{1}, Z^{1}, W^{1} U^{1}
                                                          ;
L^{1}, L^{2}, X^{1}, Y^{1}, Z^{1}, W^{1} U^{1}
                                                          ).
11. I - 4 (C<sub>5</sub>H<sub>5-e</sub> R<sup>II</sup><sub>e</sub>) 가
10
                                    I VII
                                                                                     (A)
    - 1
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IV

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VI

VII

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A 13, 14, 15 16 A

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R
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                                                                                   30
1
       30
                              6
                                     30
                                                               1
                                                                      30
                                                                                                  6
                                                                                                         30
                                                       3
                                                              30
                                                                                                                , R
              2
n
                                        ).
12.
              11
        1
                   2
1. (A)
(B)
       II - 1
(C)
((R^{31})_3 - X^{20} - Y^{20})n - Z^{20} - (R^{32})m - n
(
R^{31}
                                              30
                                                                                      30
          30
                                                                         30
                                        30
                                                                                                            30
                                 6
                                                                                                     6
                                                          , R <sup>31</sup>
                                                                                                                   R
31
X^{20}
       14
Y^{20}
       16
Z^{20}
       2
              13
R^{32}
               Ζ
                        가
m
           (m - 1)
                              ),
(D)
```

, Y ²⁰

2.

(C)

 Z^{20}

```
(R^{31})_3 - C - OR^{33}:
                                                                         Z^{20} (R^{32})m
3.
        (C)
1
(
R^{31}
                                                                                         30
                                               30
                                                                 1
          30
                                          30
                                                                            30
                                  6
                                                                                                        6
                                                                                                                30
                                                             , R <sup>31</sup>
                                                                                                                       R
31
Z^{20}
       2
              13
R^{32}
R^{33}
                                               30
                                                                                         30
1
          30
                                  6
                                          30
                                                                            30
                                                                                                        6
                                                                                                                30
             Z^{20}
                           가
m
n 1
           (m - 1)
                        ),
4. (A)
(B)
          (R^{31})_3 - C - OR^{33}
(C1)
(
R^{31}
                                               30
                                                                                         30
1
                                                                            30
                                  6
                                          30
                                                                                                        6
                                                                                                                30
                                                              , R<sup>31</sup>
R^{31}
R^{33}
                                               30
                                                                                         30
                                          30
                                                                            30
                                                                                                                30
          30
                                                                                                        6
                                                                                                       ),
             Z^{20} (R^{32})m
(C2)
(
Z^{20}
       2
              13
               Z^{20}
                           가
m
R^{32}
                               ),
```

(D) 5. 3 R^{31} 6 30 1 4 6. 3 R³¹ 가 6 30 1 7. 3 R^{31} 가 1 8. R³² 가 7 2 9. Z가 3 8 10. (A)가 II - 2 II - 6 $\mathsf{Q^{21}}_{a} \, (\mathsf{C_{5}} \, \mathsf{H_{5-a-b}} \ \mathsf{R^{38}}_{b}) (\mathsf{C_{5}} \, \mathsf{H_{5-a-c}} \ \mathsf{R^{39}}_{c}) \mathsf{M^{21}} \, \mathsf{X^{21}} \, \mathsf{Y^{21}}$ ${Q^{21}}_{a}\,(C_{5}\,H_{5\text{-}a\text{-}6}\quad {R^{40}}_{d}\,)Z^{21}\,\,M^{21}\,\,X^{21}\,\,Y^{21}$ 11 - 4 $(C_5 H_{5-e} R^{41}_e) M^{21} X^{21} Y^{21} W^{21}$ II - 5 $M^{21} X^{21} Y^{21} W^{21} U^{21}$ L^{21} L^{22} M^{22} X^{21} Y^{21} (, Q²¹ 2 5 $(C_5 H_{5-a-b} R^{38}_b) (C_5 H_{5-a-c} R^{39}_c)$ 가 (C₅ H_{5-a-b} R⁴⁰ d) Z²¹ 가 Q²² 5 R^{38} , R^{39} , R^{40} R^{41} a 0, 1 2

0 5 , a가 1 0 4

- 9 -

a가 2

b, c d a가 0

5

e 0

 M^{21} 4 6 ; M^{22} 8 10 ; L^{21} L^{22} ; L^{21} L^{22} ; L^{21} , L^{2

11. $II - 4 (C_5 H_{5-e} R^{41}_e)$ 7 I VII (A) 10

1

II

III

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VII

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a 0,1 2 ;

n m 1).

12. 1 11

1 2 .

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[ 1 ]
          , 1
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1.
                           :
                                                 , (B)
                                     (A)
                                                                                  , (C)
                          (D)
(1)(A)
                                                       (A)
                                                                          가
                            10
                                                                                                       l - 6
       I - 2
                I - 5
                                                        8
                                                               10
      I - 2
Q_a^I(C_5 H_{5-a-b} R_b^8)(C_5 H_{5-a-c} R_c^9)M^IX^IY^1
     I - 3
{Q^2}_a\,(C_5\,H_{5\,\text{-}a\,\text{-}b}\quad {R^{10}}_d\,)Z^I\,M^I\,X^IY^I
  I - 4
(C_5 H_{5-e} R^{11}_{e}) M^I X^I Y^I W^1
   I - 5
M^{I}X^{I}Y^{I}W^{1}U^{1}
I - 6
L^{1} L^{2} M^{2} X^{I} Y^{I}
                           (C_5 H_{5-a-b} R_b^8) (C_5 H_{5-a-c} R_c^9) 가
Q^1 2 5
                           (C_5 H_{5-a-b} R^{l0}_d) Z^1 가
Q^2 5
R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup> R<sup>11</sup>
```

a 0, 1 2 ;

```
b, c d a가 0
                                     5
                                           , a가 1
                                                                                      a가 2
                              0
0
          3
e 0
        5
M^1
              8
                    10
L^1 L^2
X^{1}, Y^{1}, Z^{1}, W^{1} U^{1}
L^{1}, L^{2}, X^{1}, Y^{1}, Z^{1}, W^{1} U^{1}
      I-2 I-3 Q^1 Q^2
                                           (1)
                                                                                      가
              ; (2)
                                                  가
                                                                                    ; (3) (CH_3)_2 Ge ,
(C_6H_5)_2Ge , (CH_3)P , (C_6H_5)P , (C_4H_9)N , (C_6H_5)N , (CH_3)B , (C_4H_9)B , (C_6H_5)B , (C_6H_5)
A1 , (CH<sub>3</sub>O)A1
                                                                                  [ ,
                                                                                                  가
                                              ) ] . ,
    , (C_5 H_{5-a-b} R_b^8), (C_5 H_{5-a-c} R_c^9) (C_5 H_{5-a-d} R_d^{10}) 5
                                                                                         , R^8, R^9 R
                            ; a 0, 1 2 ; b, c d a가 0
a가 2 0 3 .
                                                                                          5 , a가
                          , a가 2
1
                                       12 .
                                                                   5
      20,
                 . 2
                                                                , -Si(R ^{12})(R^{13})(R^{14}) ( , R^{12}, R^{13}
                       12
R^{14}
                                         -P(R^{15})(R^{16}), -N(R^{15})(R^{16}) -B(R^{15})(R^{16}) ( , R^{15}
                        18
                                                               (C_5 H_{5-a-b} R_b^8) (C_5 H_{5-a-c} R_c^9)
                                                 5
                               I - 2
M^1
                    6
                                                                                        . Z <sup>1</sup>
                                (-0-), (-S-),
                                                                20,
                                                                                       10
                                 12
                                                                40,
                                                                                       18
                                                                            . X <sup>1</sup>
                                                                가
                     40.
                                            18
                                                             20,
                                                                             1
                                                       1
                                                                                    10
                               10
         20.
                                                                                          12
                                                20,
                                                                  1 12
                                  ),
                           1
                                 20,
                                                        12
                                                                 가 . X<sup>1</sup> Y<sup>1</sup>
  , B(C_6 H_5)_4, BF_4)
```

- 13 -

```
I - 5
            , M<sup>1</sup>
                                                            6
              . W^{1} X^{1} Y^{1} . , W^{1}
             20.
                                                                                             10
                                   1
                                             12
                                                                     (
                                                                                              ),
                                                 ( , ) ( , B(C<sub>6</sub>H<sub>5</sub>)<sub>4</sub>, BF<sub>4</sub>)
             1 12
20,
                                                                                             20,
1
      12
               가 X^1, Y^1 W^1
                                                                                      , X^{1}, Y^{1} W^{1}
                     , U^1 = X^1, Y^1 = W^1
                                                  . , U<sup>1</sup>
               1 20, 1 10
1 20, 1
1 12
12
                                                                            20,
                                                                                                 ),
                                                     12
                                                                            (
                                                                    ) 1 20,
, B(C<sub>6</sub>H<sub>5</sub>)<sub>4</sub>, BF<sub>4</sub>)
         20.
         1
                     가 . X<sup>1</sup>, Y<sup>1</sup>, W<sup>1</sup> U<sup>1</sup>
          I - 2
                I - 3
(1)
(1)
                            )
                  )
                                                                        )
                                      )(
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                                                                  , (
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                                               2
                                                          5
                  가
(2)
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                    )
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                                 )
                                                                 (4,5,6,7 -
                                 (
                                                                (2,4 -
                  (2 -
                                                                                 )
                                                                                 - 5,6,7 -
                                                                    (2,4 -
                                      ,
)(3',5' -
)(3' - t - - 5' -
                        (2,4 -
  (2 -
               - 4 - t -
    (2,3,5 -
                                       )(2',4',5'-
                                                (2,4 -
- 4 - t -
   (2 -
                                                                  ) (3',5' -
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) , (
) (3,4 -
                                                                  )
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(3,4 -
                                                                                   , (
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- 14 -

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)(3-
(2-
)(3,4-
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                 (2,5 -
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5 -
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(3)
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                                                                    (2,4 -
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                                                             (2,3,5 -
(3',5' -
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5' -
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                                                                                   가
(4)
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                                                                                       )
                                )(
                                           )
                      가
                                          5
                                2
```

- 15 -

(6) (1,1'-)(2,2'-) () , (1,1'-)(2,2'-) (2,2'-) (1,1'-)(2,2'-) (1,1'-)(2,2'-) (1,1'-)(2,2'-) (1,1'-)(2,2'-) (1,1'-)(2,2'-) () () , (1,2'-) (1,1'-)(2,2'-) () () , (1,1'-)(2,2'-) () () , (1,1'-)(2,2'-) () () , (1,1'-)(2,2'-) () () (2,2'-) () (2,2'-) () (2,2'-) () (2,2'-) () () (2,2'-) (2,2'-) () (2,2'-) (2,

(II) I-4 , $(C_5 H_{5-e} \ R^{II}_{\ e})$ I VII :

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VII

a 0, 1 2

$$(C_5 H_{5-e} R^{\parallel}_{e})$$
 가 .

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2 -
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6,7 -
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7 -
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     , 1,3 - - 4,5,6,7 -
                                                         , 1,2,3 -
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                    . 1.2.3 -
                                  - 4.5.6.7 -
                                                                           , 1,2,3 -
                                                                                          - 4.5.6.
                                       , 1,2,3 -
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7 -
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      . 1 - - 3 - - 4.5.6.7 -
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3 - - 4,5,6,7 -
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5,6,7 -
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              , 1,2,3 - - 4,5,6,7 -
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2,3,4 -
                                               , 1,2,3,4 -
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                                            , 1,2,3,4 -
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                                               , 9 -
2,3,4 -
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9 - - 1,2,3,4 -
                                                        , 9 - - 1,2,3,4 -
           . 9 -
                   - 1.2.3.4 -
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                      , 9 -
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6,7,8 -
                                       , 1,2,3,4,5,6,7,8 -
                                                                                              , 1,
2.3.4.5.6.7.8 -
                                          , 9 - - 1,2,3,4,5,6,7,8 -
                                                           , 9 - - 1,2,3,4,5,6,7,8 -
      , 9 - - 1,2,3,4,5,6,7,8 -
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                            , 9 -
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  - 1,2,3,4,5,6,7,8 -
                                                , 9 - - 1,2,3,4,5,6,7,8 -
                 , 9 -
                        - 1,2,3,4,5,6,7,8 -
(III) I - 5
                            , , ( )
) ; [Macromolecules, 1997, 30, 1562 - 1569],
I of Organometallic Chemistry, 514 (1996), 213 - 217] ( ); [Macrom
olecules, 1996, 29, 5241 - 5243], [Organometallics, 1997, 16, 1491 - 1496]
                                                             가
(IV)
         I - 6
                                                             10
                         X^1
                                                                  1
                                                    20,
                                                                        10
    20,
                         10
                                                                         1
                                                    1
                                                            20,
                                                                                  12
                                                                 12
                             ),
                                           20,
                              20,
                                            1
                                                   12
                                                                 . X<sup>1</sup>
                                                           가
B(C_6 H_5)_4, BF_4)
                                                                 , 1,2 -
     L^{1} L^{2}
                                                                                           , 1,3 -
                    , 1,1'-
    L^{1}, L^{2}, X^{1} Y^{1}
        8
              10
                                                                        가 , I-7
```

 R^{17} R^{20} 20 1 가 7 20 R^{19} R^{18} 20 , R¹⁸ R^{19} Χ 1 20 M^2 8 10 , R¹⁷ R^{20} 20 1 - 7 1 1 20 3 20 , n -, 3 , 2 가 가 7 20 가 10 . R¹⁷ R^{20} 가 가 , 2,6 -. R¹⁷ R²⁰ R^{19} R^{18} 20 1 20 . R ¹⁸ 20 3 20 6 20 R ¹⁷ R^{19} 20 1 3 20 R 20 1 20 6 20 7 20 . R¹⁷ 20 20 . X 가 . X M^2 8 10

1-7

I - 7

12]

[1], [2], [3], [4], [5], [6], [7], [8], [9], [10], [11]

1 - 7 , (1,2 -

- 22 -

```
) ,
3 -
                                       (1,1' -
                                    , (1,2 -
     (1,2 -
                                                                                                , (2 -
        - 1 -
                            )
                                   (1,2 -
                                                                )
                         (2,2' -
        , (1,2 -
                                            )
                           (2,2' -
                                                                                                    가
(B)
        I - 8
                                                  I - 9
      I - 8
                                     R<sup>22</sup> R<sup>23</sup> R<sup>24</sup>
                                R^{21} - (Y^2 - O)a - (Y^3 - O)b - Y^4 - R^{25}
      1-9
                                         R 2 6 R 2 7
                                       -(Y^{5} - O)c - (Y^{6} - O)d -
          I - 8 I - 9 , R <sup>21</sup>
                 ,
가 . R<sup>21</sup>
                                 R^{27}
R^{26} R^{27}
                         13
                                                            B, Al, Ga, In
                                                                           ΤI
               . Y<sup>2</sup> Y<sup>4</sup>
                                                            Υ6
 ΑI
                                                                                          . a
                                                                                                  d
               , (a+b)
1 10,
         50
                                (c+d)
                                                                 d
                                                                                                 20,
                                                   5
(C) :
                I-1 :
```

- 23 -

```
((R^1)_3 - C - Y)n - Z - (R^2)m - n
R^1
           6
                   30
                                                  1
                                                          30
                                                                                        30
                                                                                                           , R <sup>1</sup>
      30
                                 6
                                         30
Y 16
Z 2
           13
R^2
              Ζ
                       가
m
         (m - 1)
n 1
                                       : (1) Y가 , Z가
; (3) 3 R<sup>1</sup> 가
                                                                                 ; (2) 3 R^{-1}
                                                                                                        ; (4) 3
   6
            30
                                                                R <sup>1</sup>
                                             ; (5) 3
2
         가
                                                                        가
                          30
                                                                                         30
                                 (6) R^2
            , R<sup>1</sup>
                                                             , n 1 , R <sup>2</sup>가
                                   , Y가 , Z가
(C)
                                                       (R^{1})_{3} - C - OR<sub>3</sub>, R^{4} - CO - R^{5} R^{6} - CO - OR<sup>7</sup>
          (R^{I})_{3} - C - OR_{3}
                                          < 1 >
1 >
                                                           Z(R^2)m
                                             <2>
                                                                      1
                       , R<sup>1</sup>
                                      6
                                             30
                                                                                    30
                                                                                                          6
                                                             30
                                30
30
                                                           6
                   , R<sup>1</sup>
                                                              , R<sup>1</sup>
R^3, R^4, R^5, R^6
                  R^7
                                                                                                          30
                                                              30
                                 30
                                                               30
                                                                                 R^{3}, R^{4}, R^{5}, R^{6}
       6
              30
Z 2
       13
                       가
              Ζ
m
```

I - 1

 R^2

I - 13

```
, (1) (R^1)_3 3 R^1; (2) (R^1)_3 3 R^1 가 1
                                                              30
                                                              3 R<sup>1</sup> 가
                                                                  , R<sup>2</sup>가
         ; (5) R<sup>2</sup>가
                                                               가
<1>
            <2>
           , <1> :<2>
1:0.8 1:1.2
                                               1:10,
                                                              1:0.5
                                      1:0.1
                                                                         1:2.
                                        - 80
                                                300 ,
                                                                 - 10
                                                                        50
                                       , (C1)
(C)
                                                           (C2)
                  가 (C)
                                                                   (A)
, (B)
                 , (C1) (C2)
                                              (D)
(C1) (R^1)_3 - C - OR^3 , (R^1)_3 - C - OR^3 , R^4 - CO - R^5 , R^6 - CO - OR^7 ; (C2) , Z(R^2)m .
                                       , 1 30
       , R<sup>1</sup>
                6
                       30
                                                                 6 30
                                 6
                                      30
              30
    , R<sup>1</sup>
                                      R^1
R^3, R^4, R^5, R^6 R^7
                                         1 30
                                                                           30
                                    6 30
                        30
                                                         , R^{3}, R^{4}, R^{5}, ^{6} R^{7}
          30
Z 2 13
       Z 가
m
R^2
 , (C1)
                         ; (2) (R <sup>1</sup>)<sub>3</sub> 3
4 30
   : (1) (R^1)_3 \quad 3 \quad R^1
R<sup>1</sup> 가 1
                               ; (3) (R^{1})_{3} 3
                                             R<sup>1</sup> 가
; (4) (R<sup>1</sup>)<sub>3</sub> 3 R<sup>1</sup> 가 6 30
                                                                       ; (5) R<sup>2</sup>
  2
                                     , (C1)
                                                            (C2)
가
(D) :
                    ,
I - 14
```

I - 12

I - 12

```
R^{28} _{m} AI (OR^{29})_{n} X_{3-m-n}
I - 13
R^{28}_{2}Mg
I - 14
R<sup>28</sup> <sub>2</sub> Zn
R^{28}
     R^{29}
                   1 8,
Χ
                         3, 가
                     2
m = 0 < m = 3,
                                           3
n 0 n < 3
                          1 ).
                     0
2.
(1)
                                                   가
(i) (A) , (B) (C)
                                                                           (B)
                       가
                                         ; <2> (A)
                                                        (C)
               (C)
                                                                                  (B)
                     ; <3> (B)
                                      (C)
                                                               (A)
                                                                          가
       <4>3
   가
      (D)
                              , (D)
                          , (A) (D)
                                                       ; (B)
                                                                      (D)
       (C)
                                                      , (A), (B) (D)
                 (D)
                        . (ii) (A) , (B) , (C1)
        (C)
                                                        (C2)
                           가 (i)
                      (C1) (C2)
                                                                             가
                                                         . (i)
```

```
(D)
                          (ii)
(2)
<1>(A)
           (B)
                                                (B)
                                                                           가
            , (A) (B)
                                   (B)
                                                                   1:1
                                                                          1:10,0
            1:10 1:1,000
                                               (C) 7h
1:0.5 1:1,000,
. (A) (D)
, (A) (D)
1:1 1:100 .
<2> (A) (C)
                           (C)
 , (A) (C)
   1:0.8 1:100,
                                  1:100
                            1:1
                                  가
               (D)
                                                                           (D)
                         1:0.5 1:1,000,
                (C1) (C2) , (C1) (C2)
1:0.1 1:10, 1:0.5 1:20, 1:0.8 1:10, 1:0.5 1:2 1:0.8
                                                   , (C1) (C2)
<3> 가(C)
0.1 1:50,
1:1.2, 가
                1:0.8 1:10
     (C2)
(C2)
                   ,
(C2)
                                         (C2)
                                                             가
(A)
                                                             1:1,000,
(A)
                                                     1:0.5
                                          , <2>
:1 1:100
                    . (D)
                                                             가 <3>
(3)
                                            , 가
                                - 30
                                         200
                                                                      . (4)
                            (B)
                                                                         SiO_2, A
                                          가
I_2O_3, TiO_2, Fe_2O_3, B_2O_3, CaO, ZnO, BaO, ThO _2,
. , SiO<sub>2</sub> Al<sub>2</sub>O<sub>3</sub>가 .
                                                            300 \mu m,
                                                                         10
                                                       1
200\mum,
                          100μm .
                    20
П.
1. :
                                           20
  , ,1- ,3- -1- ,4- -1- ,4- -1- ,1- ,3- -1-
-1- ,3,3- -1- ,3,4- -1- ,4,4- -1- ,1- ,4- -1- ,5
```

, 3,4 -, 5 -, 5 -, 5 -, 5 -가 5,6 -가 () 2. 가 - 20 200 , 130 (C1) (C2) , (C) , (A), (B) (D) (C) (C1) (C2) 2 , , , n- , n- , , 1,2 -가 , 1 (A) 0.1 10 0.5 25 µ mol 0 μ mol, (常壓) 2000kg/cm ²G(196MPaG) - 50 250

```
1,2,4 -
                          [mmmm]
           (90:10,
                       )
                                       , <sup>13</sup> C - NMR(JEOL LA - 500)
                                                                        130
                                                                                                      (prot
on complete decoupling method) 가
                                                                             (signal)
          [mmmm]
                                                     (A. Zambelli)
                                                                           [Macromolecules, 6, 925 (1973)
                       <sup>13</sup> C
]
               [mmmm]
(isotactic)
    [Macromolecules, 8, 687 (1975)]
                      (Mw; molecular weight)
                                                                (Mw/Mn; molecular weight distribution)
GPC
[ [-1]
(1) (C) :
455mg(1.75mmo1)
                                                 0.875₩
                                                            2M
                                                                                         - 78
                                                                                                      가
         24
                                                     (C)
                                                                       O.1mo1/
                             , (C)
        <sup>1</sup>H-NMR
(2)
27.1g SiO<sub>2</sub>[
                                       P-10] 500Mℓ
                         (Fuji Silica)
                                                               (Schlenk)
                                                                                                200
                 . 25.9g
                                SiO<sub>2</sub>
                                                             SiO<sub>2</sub>
                                                                                                - 78
    400Mℓ
                                                        145.5Mℓ
                                                                                        (1.5mol/)
                                                         . 4
                                           1
                                                                                       6
  20
            가
                                           가
                                                                                     20
                                                                        1
                                                                                               80
                  80
                                                                           2
                60
                                                       400Mℓ
                                              60
                               60
                                                                                 가 23.12
                                                                                             % 33.69g
                                                                                      가
                                                                                                500Meノト
                                       . n -
                                                                           가
                                        O.27mol/
(3)
                                      . 400Mℓ
                                                                                                     0.5mm
                                                                                              0.25mmol
                         , 50 µ mol
                                          (1)
                                                         (C)
                                                                          (2 -
                                                                                  - 4.5 -
  (2)
                                               1 µ mol
                 가
                                                   가
                                                                                         0.785MPaG(8.0kg/
cm<sup>2</sup>G)가
                                                                          70
                                                                                    60
                                                33.2q
                                                                                               (
                                           (Mw) 1,070,000
                                                                                              2.07
35 ), [ ] 1.2
                                                                                  (Mw/Mn)
                  97.2%
      I - 1]
[
(1)
           I - 1(2)
```

```
(2)
     I - 1(3)
                               I - 1
                                                     , I - 1(1)
                                                                             (C)
                가
       16.0g
                                                     135 ), [ ] 1.3 ;
     (Mw) 1,100,000
                                  (Mw/Mn)
                                            2.04
                                                                96.8% .
[ 1-2]
(1) (C) :
1.75mmol
                                  [
                                       (Across) ] 0.875Mℓ
                                                           2M
      가
- 78
                       24
                                                                   O.1mo1/
                                                      (C)
     <sup>1</sup> H - NMR
                     , (C)
(2)
         5
                               , 400Mℓ
                                                                            0.
                    , 50 µ mol
                                                                        0.25mmo
5mmol
                               (1)
                                           (C)
                     I - 1(2)
                                                              1 µ mol
                                                                가
(2 -
       - 4,5 -
                                       가
           0.785MPaG(8.0kg/cm <sup>2</sup>G)가
                                                                             7
     60
                                                            28.4g
                       (Mw) 1,190,000 ;
                                                    (Mw/Mn) 2.04 ;
 97.1% .
[ 1-3]
(1)
     - 1 -
        ,40M0 1- ,0.5M0
360₩
                                                      , 50 μ mol I - 1(1)
                            1M
       (C)
                                   0.25mmol I - 1(2)
                                                                        가
                        1.6
                                                                , 70
                                  0.785MPaG(8.0kg/cm <sup>2</sup>G)가
                                                                       , 20№
                                         _ 5 _
        1.0 µ mol (t - )
                                  (
                                                            )
                                         0.785MPaG(8.0kg/cm <sup>2</sup>G)가
                                                                        60
                                가
                                                                              가
                                         60 4
                                                                        , 33.8g
    - 1 -
                                                             61,000 ;
                                           (Mw)
 (Mw/Mn) 2.24
     1 -
                  18.4mol% .
[ 1-2]
```

```
가
3g -1-
  (C)
                                          I - 3
                                                                                   18.
                                            (Mw)
                                                                  64,000 ;
   (Mw/Mn) 2.06 .
      1 - 18.3mol% .
[
     I - 4]
      ) ( - <sup>5</sup> -
(t -
                                              ) -
                                                                        2,2 - t - - 4,4 -
                                                       I - 3
                                                                                31,000
       29.3g
               - 1 -
                                                             (Mw)
              (Mw/Mn) 2.24
               18.4mol% .
      1 -
[
      I - 3]
                가
                                                                      . , 19.
34,000 ;
(C)
       - 1 -
4g
                                                   (Mw)
       (Mw/Mn) 2.06 .
       1 - 18.3mol%
[ 2
       1
                   2 가" "
                                                      . I.
1.
                                         , (B)
II - 1
                           (A)
           , (c)
                                                               (D)
(1)(A)
         , 1
(B)
                                                    :
                                                    11 - 7
                                                           11 - 8
([L^{23} - H]^{g+})h([M^{23} X^{22} X^{23} \cdot \cdot \cdot X^{n}]^{(n-m)})_{i}
([L^{24}]^{g+})h(M^{24}X^{22}X^{23} \cdot \cdot \cdot X^{n}]^{(n-m)}
```

```
I 24
                                                                                    M^{25} , R^{51} R^{52} M^{26}
                                                                                                                                                                         R^{53} <sub>3</sub> C
L^{23}
 M^{23}
                            M^{24}
                                                                                                         5
                                                                                                                                   15
 M^{25}
                                                             1
                                                                                      8
                                                                                                                12
 M^{26}
                                                             8
                                                                                      10
X^{22}
                                X^n
                                                                                                                                                                                                                                                                                  1
                                                                                                                                                                                                                                                                                                            20
                                                                                                                                                                                                                                                                                                                                                                                      6
                                                                                                                                                                                                                                                                                                                                                                                                               2
 0
 R^{51}
                         R^{52}
R^{53}
                                                    M^{24}
                                                                                            가
m
                                                                                                                                              , 1
                                                                                                                                                                            7
               2
                                        8
n
               L<sup>23</sup> - H
                                                             L^{24}
                                                                                                                         가
                                                                                                                                                                          , 1
                                                                                                                                                                                                        7
h
            h \times g/(n - m)
M^{23}
                           M^{24}
                                                                                                                                                                                                                                                             ; M <sup>25</sup>
                                                                                                         B, AI, Si, P, As, Sb
                                                                                                                                                                                                                  가
                                                                                                                                                                                                                                                                                                                                                       Ag, Cu, Na, Li
                                                                    ; M<sup>26</sup>
                                                                                                                                                                                                                                                                            . X <sup>22</sup>
                                                                                                                                                                                                                                  가
                          가
                                                                                                                                                                                                                                                                                                                     Xn
                                                                                                                                                         Fe. Co. Ni
                                                                                                                                                                                                                     20
                                                                                                                                                                                                                                                                                                                                      , n -
               , 2,6 -
                                                                                                                                                                                            1
                                                                                                                                                                                                                        20
                                                       , n -
                                                                                                                                                                                              6
               , n -
                                                                                                                                           , 3,5 -
                                                                                                                                                                                                                                                                           4-3 -
                                                                                                                                                                                                                                                                                                                                                 , 2,6 -
p -
                                                                                                                                                                                                                                            )
 3.5 -
                                                                  , 2,4 -
                                                                                                                                        , 1,2 -
                                                                                                                                                                                                                                                                              F, Cl, Br, I;
                                                 . R<sup>51</sup>
                                                                               R^{52}
                                                                                                                             가
                                                                                                                                                                                                                                            B(C_6F_5)_4, B(C_6HF_4)_4, B(C_6H_2F_3)_4, B
 (C_6H_3F_2)_4, B(C_6H_4F)_4, B[C_6(CF_3)F_4]_4, B(C_6H_5)_4, PF_6, P(C_6F_5)_6, AI(C_6HF_4)_4
                                                                                      , Cp_2Fe^+, (MeCp)_2Fe^+, (tBuCp)_2Fe^+, (Me_2Cp)_2Fe^+, (Me_3Cp)_2Fe^+, (Me_4Cp)_2Fe^+
 ^{+}, (Me_5Cp)_2Fe^{+}Ag^{+}, Na^{+}, Li^{+}
                                                                                                                                                                          , 2,5 -
                                                                                                                                                                                                                                                                                                        - N,N -
N<sub>1</sub>N<sub>-</sub>
                                                                          , N,N -
                                                                                                                                                                                                                                                                                                                                                (4 -
                                                                                                                                                                                                                                                                                                                                                                                              )
                (4 -
                                                                                                                                                                                         ; CH_3PH_3^+, C_2H_5PH_3^+, C_3H_7PH_3^+, (CH_3)_2PH_2^+, (C_2H_3PH_3^+)
_{5}\,)_{2}\,PH_{2}\,^{+}\,,\; (C_{3}\,H_{7}\,)_{2}\,PH_{2}\,^{+}\,,\; (CH_{3}\,)_{3}\,PH^{+}\,,\; (C_{2}\,H_{5}\,)_{3}\,PH^{+}\,,\; (C_{3}\,H_{7}\,)_{3}\,PH^{+}\,,\; (CF_{3}\,)_{3}\,PH^{+}\,,\; (CH_{3}\,)_{4}\,P^{+}\,,\; (C_{2}\,H_{5}\,)_{4}\,P^{+}\,,\; (C_{3}\,H_{7}\,)_{3}\,PH^{+}\,,\; (CF_{3}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_{7}\,H_
                                                                                                                                              ; C_6 H_5 PH_3^+, (C_6 H_5)_2 PH_2^+, (C_6 H_5)_3 PH^+, (C_6 H_5)_4 P^+, (C_2 H_5)_2 (C_6 H_5)_4 P^+
 (C_3 H_7)_4 P^+
_{6} H_{5} )PH^{+} , (CH_{3} )(C_{6} H_{5} )PH_{2} ^{+} , (CH_{3} )_{2} (C_{6} H_{5} )PH^{+} , (C_{2} H_{5} )_{2} (C_{6} H_{5} )_{2} P^{+}
```

```
11 - 2
                    11 - 3
                                                                                                                  11 - 2
                                                    (n -
                                                                           (n -
                                                                                     )
                                                                              (
          )
                        , N,N -
                                                           11 - 3
                            (
                                         )
        (
                                )
                                                                                 (
                                                                                                        )
                                         )
                                                                                                                                         )
                                 , B(C_6F_5)_3, B(C_6HF_4)_3, B(H_2F_3)_3, B(C_6H_3F_2)_3, B(C_6H_4F)_3, B(C_6H_5)_3, BF_3, B
[C_6(CF_3)F_4]_3, PF_5, P(C_6F_5)_5, AI(C_6HF_4)_3
(C) :
                      II - 1
         II - 1
((R^{31})_3 - X^{20} - Y^{20}) n - Z^{20} - (R^{32}) m - n
R^{31}
                                                                                                             30
             30
                                          6
                                                   30
                                                                                             30
                                                                                                                                         30
                                                                                                                                6
                                                                            , R <sup>31</sup>
                                                                                                                                                  R
31
X^{20}
         14
Y^{20}
         16
Z^{20}
        2
                  13
R^{32}
                           가
m
n 1
              (m-1)
                                       : (1) X<sup>20</sup>
                                                                   , Y<sup>20</sup> 가
                                                                                                                                           R^{31}
                                                                                                                           ; (2) 3
                                                                                          R^{31}
                                                                            ; (3) 3
                                                                                                         가
                                  30
                       R^{31}
                                                                                                          R^{31}
                                   가
                                                         30
                                                                                          ; (5) 3
                                                                                                                      가
        ; (4) 3
                                                4
                                                                                                                                            30
                                                               ; (6) R<sup>32</sup> 가
                                                                                          2
                                                , X<sup>20</sup>
                , R<sup>31</sup>
                                                                                                                                      , R<sup>32</sup> 가
                                                                      , Y<sup>20</sup>
                                                                                            , Z<sup>20</sup>
                                                                                                                        , n 1
```

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```
(C)
(R^{31})_3 - C - OR^{33} (R^{31})_3 - C - OR^{33}, R^{34} - CO - R^{35} R^{36} - CO - OR^3
                                                            < 2 > Z(R^{32})m
                                   , R<sup>31</sup>
                                                                            1
                                                                                      30
6
       30
                                                                               30
                                                30
                                                                                                   , R <sup>31</sup>
                      6
                             30
                                                                                             ; \mathsf{R}^{33} , \mathsf{R}^{34} , \mathsf{R}^{35} , \mathsf{R}^{36}
                                    R^{31}
                                                                                       30
                                     1
          30
                                     30
                                                                   1 30
                                                                                                             30
                                                             , R^{33} , R^{34} , R^{35} , R^{36}
                                                                                        R^{37}
                                                                   Z <sup>20</sup>
    ; Z<sup>20</sup>
                                                                                                        ; R<sup>32</sup>
                                                                               가
                    13
                                                  ; m
                                  : (1) 3
                                                                                  30
                                                                          6
                   가
                                                                         R <sup>31</sup>
                                                             ; (3) 3
                                                                                  가
                                                                                                     30
                   R^{31}
                                                                                                          ; (5) R <sup>32</sup> 가
         ; (4) 3
                               가
                                                 30
                                                                          , R<sup>32</sup> 가
                                                , R^{31}
                                                                   가
< 1 >
                    <2>
                    , <1>
                                    :<2>
                                                                 1:0.1
                                                                             1:10,
                                                                                                       1:0.5
                                                                                                                  1:
                      1:0.8 1:1.2
                                                                             300 ,
2,
                                                                  - 80
                                                                                                          - 10
                    0.1 50
                                                                 0.1
                                                             , (C1)
(C)
                                                                                        (C2)
                                                    (C)
                                                                                                            (A)
           , (B)
                                , (C1) (C2)
                                                                        (D)
           (R^{31})_3 - C - OR^{33}
                                                     (R^{31})_3 - C - OR^{33} , R^{34} - CO - R^{35}
                                                                                                    R<sup>36</sup> - CO - OR<sup>37</sup>
(C1)
                                                           ; (C2)
                                                                            Z(R^{32})m
            , R^{31}
                                                                           ,
1 30
, R <sup>31</sup>
                       30
                                              6
                                                                      ; R^{33} , R^{34} , R^{35} , R^{36} , R^{37}
             R^{31}
              1
                       30
                                                                30
                                                                                                         30
                                                       6
           6 30
                                            1 30
                                                                                       30
                                       , R^{33} , R^{34} , R^{35} , R^{36} Z ^{20} 가
                                                                                 ; R<sup>32</sup>
                            ; m
            , (C1)
                                              ; (C2)
                                                                                  ; (2) 3 R <sup>31</sup>
            R^{31}
: (1) 3
                                               30
                                     R^{31}
                                               가 4
                          ; (3) 3
                                                                 30
                                                                                          ; (4) 3
                                                                     ; (5) R ^{32}
            30
     6
                                                  (C2)
                                                                                     가
                  , (C1)
```

(D) : , 1 2. (1) 가 1 (2) <1>(A) (B) (B) (B) <2> (A) (C) , (A) (C) (C) 1:0.8 1:100, 1:1 1:100 가 (D) 1:0.5 (C1) (C2) , (C1) (C2) 1:
1:0.1 1:10, 1:0.5 1:20, 1:0.8 1:10, 1:0.5 1:2 1:0.8
1:0.8 1:10 . (A) (C2) ,
フト . , (A) (C2) (C2)
1:0.5 1:1,000, 1:1 1:100 . (D)
2> フト <3> . <3> 가(C) 0.1 1:50, 1:1.2, 가 (C2) <2> (3) : - 30 200 (4) (B) 가 П. : 1.

(,

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```
20
                                          2
                                                                             가
                                           가
                                                                 ( )
2.
                              가
                                                         , 1
                                                                 (A)
                                                                                   0.1
                                                           1
                             25 \, \mu \, mol
   100 μ mol,
                      0.5
                                     2000kg/cm <sup>2</sup> G(196MPaG)
          250
[ | | | | | | |
                                          0.875₩
                                                                                    가
(1) 455mg(1.75mmol)
                                                  2M
                                                                          - 78
                                                     O.lmol/ .
         24
                                            (C)
          , 40Mℓ 1- , 1.0Mℓ 1.0M
                                                                , 0.1Mℓ N,N -
(2) 360Mℓ
                                         (10mmo1/ )
                                                      5Mℓ
                                                                          (C)
                                                               (1)
                                         , 70
                                                      가
            1.6
                                                               .
            0.785MPaG(8kg/cm <sup>2</sup>G)가
                                                      , 20Mℓ
                                                                         1.0 µ mol (t
         ) ( - 5 -
                                                                        8kg/cm<sup>2</sup>G가
                                               가
60
가 ,
1
                                                  60
                                                                                    , 4
                                                       4
                                  . GPC
                              2.46 . <sup>1</sup> H - NMR
                                                                         1 -
1,270,000
18.4mol% .
[ | | | | | | | |
  II - 1(1)
                         (C)
                                       II - 1(2)
                                                                가
                                           35.3g - 1 -
                                                                             . GPC
II - 1
                                                                            2.38 . <sup>1</sup> H
                                            1,170,000 ,
- NMR
                                 1 -
                                            16.7mol% .
[ | | | | | | | |
```

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```
400Me , 1.0Me 1.0M
                                      , 0.1Me (
                                (C)
 (10mmo1/ ) 5Me II - 1(1)
                                                        , 70
                                                                 가
                                0.785MPaG(8kg/cm <sup>2</sup>G)가
                                                                 , 20Mℓ
                                   _ 5 _
       1.0 μ mol (t - )
                                (
 0.785MPaG(8kg/cm <sup>2</sup>G)가
가
                               60
                                      60 4
                    . GPC
16.2g
1,140,000 ,
                    1.98 .
[ II-2]
                                    가
 II - 1(1)
                 (C)
                                                     II - 2
                                    . GPC
                10.5g
                                    2.02 .
              1,090,000 ,
[ II - 3]
(t- ) ( - <sup>5</sup> -
                                    ) -
                                    II - 2
                 . GPC
4g
                                                                 1,090,0
00 ,
                 2.02 .
[ 11-3]
(C)
                                   II - 3
                                                                 3.7
                . GPC
                                                                1,090,00
0 ,
                2.02 .
[ | | | | | | | |
(1) (C) :
                                                 ( ) - 78 가
O.lmol/ .
0.875Mℓ 2M
                   1.75mmol
                                     (C)
    <sup>1</sup> H - NMR
                  , (C)
(2)
   II - 1(1)
                                    (1)
                                                    (C)
                    (C)
            II - 1
                                             8.7g
                                                                 . G
                                           1,100,000 ,
PC
                                                                 2.05
[ II-5]
           ( - 5 -
(t - )
                                   ) -
                                                     II - 2
                                   . GPC
             34.1g
             1,050,000 ,
                                   2.03 .
```

```
[ | | | | | | | | | | |
                                                            II - 5
(C)
                                                                                                                1
                                     . GPC
                                                                                                              980,
6.4g
000
                             2.04
               가
                                                                                                가 .
(57)
       1.
(A)
(B)
(C)
                I - 1
(D)
      I - 1
((R^{I})_{3} - C - Y)n - Z - (R_{2})m - n
R^1
                   30
                                                           30
                                                                                        30
            6
                                                                                 6
                                                                                                           , R <sup>1</sup>
1
       30
                                  6
                                         30
                                             R^1
Υ
    16
Z 2
           13
R^2
                       가
m
              Ζ
       (m - 1)
n 1
       2.
```

(C) Y가 Z가 3. 1 $(R^{1})_{3} - C - OR^{3}$ $Z(R^2)m$ (, R¹ (C) 30 1 30 30 30 6 6 30 , R ¹ ; R³ R^1 1 30 6 30 30 1 6 30 30 1 6 30 ; Z 2 13 Ζ 가 ; m R^2) 4. (A) (B) (, R¹ (C1) $(R^1)_3 - C - OR^3$ 30 30 6 6 30 30 30 , R¹ R^1 ; R³ 30 30 30 30 30 30 6), (C2) $Z(R^2)m$ Ζ 가 (, Z 2 13 ; m ; R²), (D) 5. 4 R^1 6 30 6. 1 4

- 39 -

30

 R^1

7.

3

가

```
1 4
3 R<sup>1</sup> 가
 8.
1 7
R<sup>2</sup>가 2
        9.
3
      8
Z가
       10.
      9
 1
              (A)가 I-2 I-6
 I - 2
Q_a^I (C_5 H_{5-a-b} R_b^8) (C_5 H_{5-a-c} R_c^9) M^I X^I Y^1
     I - 3
{Q^2}_a \, (C_5 \, H_{5 \, \hbox{-}\, a \, \hbox{-}\, b} \, R^{10}_{\ d}) Z^I \, M^I X^I Y^1
   I - 4
(C_5 H_{5-e} R_{e}^{II}) M^I X^I Y^I W^1
     l - 5
M^{I}X^{I}Y^{I}W^{1}U^{1}
 I - 6
L^{I}L^{2}M^{2}X^{I}Y^{I}
                            (C_5 H_{5-a-b} R_b^8) (C_5 H_{5-a-c} R_c^9) 가
Q^1 2
               5
                           (C_5 H_{5-a-b} R^{10}_d) Z^1 가
Q^2 5
R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup> R<sup>11</sup>
```

a 0, 1 2 ; b, c d a710 0 5 , a711 0 4 a712 e 0 5 ; M^1 4 6 ; M^2 8 10 ; L^1 L^2 ; X^1, Y^1, Z^1, W^1 U^1 ; $L^1, L^2, X^1, Y^1, Z^1, W^1$ U^1 . 11. 10 ,

 $I - 4 \quad (C_5 H_{5-e} R^{11}_{e})$ $7 \vdash I \quad VII$ (A)

1

II

III

IV

٧

۷I

VII

A 13, 14, 15 16 A ;

R , , , 1 30 , 6 30 , 1 30 , 6 30 , 7 1 30 , 6 30 , 7 1 30 , 7

```
a 0, 1 2 ;
  m 1
n
    12.
              11
1
       13.
(A)
(B)
               II - 1
(C)
(D)
     II - 1
((R^{31})_3 - X^{20} - Y^{20}) n - Z^{20} - (R^{32}) m - n
R^{31}
                                        30
                                                                           30
        30
                                                                30
                                   30
                                                                                             30
                                                                                        6
                                                    , R<sup>31</sup>
                                                                                                    R
31
X^{20}
      14
Y^{20}
      16
Z^{20}
      2
            13
R^{32}
        Z
                    가
m
n 1 (m-1)
     14.
```

(C) Y²⁰ Z^{20} 15. 13 , $(R^{31})_3 - C - OR^{33}$ 30 , 6
, 1 30
, R^{31} $Z^{20} (R^{32})m$ (, R^{31} 30 30 6 30 30 ; R 32 ; R³³ ; Z²⁰ 2 13 1 30 30 6 30 6 30 1 30 6 30 Z^{20} ; m ; n 1 (m - 1)) 16. (A) (B) (C1) $(R^{31})_3 - C - OR^{33}$ (, R^{31} , 1 30 30 30 , 6 30 ; R³³ 30 30 6 30 30 30 6 (C2) $Z^{20} (R^{32}) m$ $(, Z^{20}$; R^{32} Z^{20} 가 13 ; m), (D) 17. 13 16 3 R³¹ 6 30 18. 13 16

- 44 -

3 R³¹

가

6

19. 13 16 3 R³¹ 가 20. 13 19 R³² 가 2 21. 15 20 Z가 22. 13 21 (A)가 II-2 II-6 II **-** 2 ${\rm Q^{21}}_{a}\,({\rm C_{5}\,H_{5-a-b}}\ {\rm R^{38}}_{b})({\rm C_{5}\,H_{5-a-c}}\ {\rm R^{39}}_{c}){\rm M^{21}}\ {\rm X^{21}}\ {\rm Y^{21}}$ II - 3 ${\sf Q^{21}}_{\sf a}\,({\sf C_5\,H_{5\text{-a-6}}}\ {\sf R^{40}}_{\sf d}){\sf Z^{21}}\ {\sf M^{21}}\ {\sf X^{21}}\ {\sf Y^{21}}$ 11 - 4 $(C_5 H_{5-e} R^{41}_e) M^{21} X^{21} Y^{21} W^{21}$ II **-** 5 $M^{21} X^{21} Y^{21} W^{21} U^{21}$ II - 6 $L^{21} L^{22} M^{22} X^{21} Y^{21}$ $(C_5 H_{5-a-b} R^{38}_b) (C_5 H_{5-a-c} R^{39}_c)$ 7 Q²¹ 2 5

(C₅ H_{5-a-b} R⁴⁰ d) Z²¹ 가

 Q^{22}

•

a O, 1 2 ;

b, c d a가 0 0 5 , a가 1 0 4 a가 2 0

3 ;

e 0 5 ;

 M^{21} 4 6 ;

 M^{22} 8 10 ;

 L^{21} L^{22} ;

 X^{21} , Y^{21} , Z^{21} , W^{21} U^{21} ;

 $\mathsf{L}^{21} \;,\, \mathsf{L}^{22} \;,\, \mathsf{X}^{21} \;,\, \mathsf{Y}^{21} \;,\, \mathsf{Z}^{21} \;,\, \mathsf{W}^{21} \qquad \mathsf{U}^{21} \;.$

23.

, ,

II-4 (C₅H_{5-e} R⁴¹ e) 가 I VII (A)

1

RAAR

II

R R R

III

IV

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VII

A 13, 14, 15 16 A ;

R , , , 1 30 , 6 30 , 1 30 , 6 30 , 7 1 30 , 6 30 , 7 1 30 , 7

a 0, 1 2 ;

n m 1 .

24.

13 23

•