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2003 12 25

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(71) 20124 25

(72) 19382 193

19711 1

(74)

:

(54)

) , (iv) , - (i), (ii), - (iii)
(b) , , 1 , , (a)
1:3 , , . , , ,

1

, , , , ,

(smectite clay)

(nanocomposite)

(montmorillonite)

(layered clay mineral)

가 (1nm=10)

(:)

(intercalation)
(shear mixing)

가 ,
(,)

/

2001/10008699 (

6,395,386
(platelet)

4,764,326
(c)

(a)

(b)

4,810,734

(:)

가

가

(organoclay)

5:3

가

10+:3

가

[]

(i),

(ii),

(iii)

(iv)

1

(intercalating agent)

(ash)

(a)

(b)

1:3

가,

1

(MPa)

(%)

4

(LLDPE),

(LDPE),

/C₄-C₈

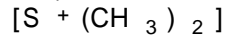
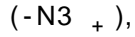
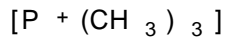
(volkonskoite), (stevensite), (hectorite), (saponite), (nontronite), (saucanite), (beidellite), (sobockite), (svinfordite)가

1

가

(onium) 가

가



(2-), (4),

(a)

3

1

(b)

(behenamide),

(c)

(d)

가

1:3,

2:3

4:3

, 9:3

가

가



(MFR: Melting Flow Rate)

가



가

(HDT: Heat Distortion Temperature)

가

1

(a)

(b)

(ii),

(iii)

(iv)

(i),
23

1:3

가

가

가

가

가 :

ASTM D-638-89

ASTM D-790-86

(Notched Izod impact) ASTM D-256-87

ASTM D-5630-01

MFR () (230 , 2.16kg) ASTM D-1258

_____ 1

1 40mm 2 (Coperion corotating twin screw extruder)
 190 , 400rpm 5oz (Battenfeld molding machin
 e) ASTM (tensile bar) [: 199 (390), 60 (140),
 25.4mm/sec(1in/see)]. 1
 1 (PP) (Basell USA Inc.) MFR 4dg/10min
 . MA-g-PP (Eastman Chemical Company) 가가 45
 (Mn) 3900 (Mw) 9100 E43(E
 polene E43) 20A(Cloisite 20A) (38%, 62%),
 (Southern Clay Products, Inc.) ((tallow)) () 4
 210 (Fiberstab 210 stabilizer)
 (Ciba Specialty Chemicals Corporation) FS-042 (50
 %) (Chimassorb) 119 (50%) (Rohm amp; Haas)
 280(Adawax 280) - (EBS)

[1]

	1	2	1	2	3	4	5	6
PP(%)	100	91.80	95.80	94.80	93.80	92.80	87.80	87.80
MA-g-PP(%)		5.00					5.00	7.00
EBS(%)			1.00	2.00	3.00	4.00	4.00	2.00
(%)		3.00	3.00	3.00	3.00	3.00	3.00	3.00
(%)		0.20	0.02	0.20	0.20	0.20	0.20	0.20
2.16kg	4.0	4.4			4.4			

MFR(dg/10)								
(MPa/kpsi)	36.2 /5.25	36.3 /5.26	35.8 /5.19	36.1 /5.24	35.6 /5.16	36.1 /5.23	34.4 /4.99	35.5 /5.15
(%)	11.3	9.6	8.6	7.8	7.3	7.3	7.2	7.5
(%)	40	92	79	106	131	111	69	89
(MPa/kpsi)	47.7 /6.92	48.9 /7.09	50.3 /7.30	50.8 /7.37	50.6 /7.35	51.3 /7.44	49.4 /7.16	50.6 /7.34
(MPa/kpsi)	1475 /214	1586 /230	1662 /241	1724 /250	1779 /258	1772 /257	1696 /246	1696 /246
(%)	—	7	13	17	21	20	15	15
[J/m(ft*lb/in)]	26.7 (0.5)	32.0 (0.6)	37.4 (0.7)	48.0 (0.9)	64.1 (1.2)	58.7 (1.1)	42.7 (0.8)	37.4 (0.7)
(%)	0	1.57	1.84	1.85	1.83	1.83	1.80	1.86

1 EBS MA-g-PP MA-g-PP
 가 EBS 가 EBS 가 MA-g-PP
 MFR 가 MFR 가 MFR 가 3 MFR
 가). EBS가 가 (

EBS MA-g-PP (1 5 6) 가
 , MA-g-PP 가 EBS 4 , 5

2
 , MA-g-PP MA-g-PP (GMS)
 , ASTM 1
 2
 PP, MA-g-PP, 1

[2a]

	1	2	1	2
PP(%)	100	91.80	95.80	94.80
MA-g-PP(%)		5.00		
GMS(%)			1.00	2.00
(%)		3.00	3.00	3.00

(%)		0.20	0.20	0.20
2.16kg MFR(dg/10)	4.0	4.4	4.0	
(MPa/kpsi)	36.2/5.25	36.3/5.26	36.2/5.25	36.3/5.26
(%)	11.3	9.6	9.1	8.9
(%)	40	92	107	103
(MPa/kpsi)	1475/214	1586/230	1703/247	1655/240
(MPa/kpsi)	47.7/6.92	48.9/7.09	49.8/7.23	49.9/7.24
(%)	—	7	15	12
[J/m(ft*lb/in)]	26.7(0.5)	32.0(0.6)	37.4(0.7)	42.7(0.8)
(%)	0	1.57	1.83	1.83

[2b]

	3	4	5	6
PP(%)	93.80	92.80	87.80	87.80
MA-g-PP(%)			5.00	7.00
GMS(%)	3.00	4.00	4.00	2.00
(%)	3.00	3.00	3.00	3.00
(%)	0.20	0.20	0.20	0.20
2.16kg MFR(dg/10)				
(MPa/kpsi)	35.3/5.12	34.5/5.00	34.1/4.94	35.6/5.16
(%)	8.9	8.7	9.6	9.1
(%)	126	104	120	64
(MPa/kpsi)	1661/241	1641/238	1489/216	1572/228
(MPa/kpsi)	47.8/6.94	46.9/6.80	45.0/6.53	48.0/6.96
(%)	13	11	1	7
[J/m(ft*lb/in)]	53.4(1.0)	53.4(1.0)	37.4(0.7)	26.7(0.5)
(%)	1.85	1.97	2.08	2.19

가 GMS (1 4) 3
 가 MA-g-PP (2) .
 . GMS MA-g-PP (5 6) GMS

3

3

MA-g-PP

, ASTM

1

3

PP, MA-g-PP,

1

B(Kemamide B)

S-180 2

(Crompton Corporation)

[3]

	1	2	1	2	3
PP(%)	100	91.80	94.80	94.80	94.80
MA-g-PP(%)		5.00			
B(%)			2.00		
S180(%)				2.00	
EBS(%)					2.00
(%)		3.00	3.00	3.00	3.00
(%)		0.20	0.20	0.20	0.20
2.16kg MFR(dg/10)	4.0	5.2	4.6	4.8	4.6
(MPa/kpsi)	36.2 /5.25	35.4 /5.14	34.5 /5.01	34.1 /4.95	34.9 /5.06
(%)	11.3	9.3	8.8	8.9	7.8
(%)	40	72	95	81	98
(MPa/kpsi)	1475 /214	1544 /224	1613 /234	1579 /229	1689 /245
(MPa/kpsi)	47.7 /6.92	47.8 /6.94	47.6 /6.91	47.1 /6.83	49.1 /7.12
(%)	—	5	9	7	14
[J/m(ft*lb/in)]	26.7 (0.5)	32.0 (0.6)	37.4 (0.7)	37.4 (0.7)	48.0 (0.9)
(%)	0	1.94	1.77	1.78	1.80

EBS

3

가 가

가 2

4

가

가

, ASTM

1

4

5

PP, MA-g-PP, (Glycomul) TS K 1 . STS (Lonza Inc.)
 (Paricin) 285 (Abril Industrial Waxes Ltd.) (Abriflo) 65 (Lonzest) SMS
 (Paricin) 220 (CasChem Inc.)

[4]

	1	2	1	2	3
PP(%)	100	91.80	94.80	94.80	94.80
MA-g-PP(%)		5.00			
GMS(%)			2.00		
STS(%)				2.00	
SMS(%)					2.00
(%)		3.00	3.00	3.00	3.00
(%)		0.20	0.20	0.20	0.20
2.16kg MFR(dg/10)	4.0	5.2	5.0	5.3	5.1
(MPa/kpsi)	36.2 /5.25	35.4 /5.14	34.3 /4.98	34.7 /5.03	34.7 /5.03
(%)	11.3	9.3	9.1	9.1	7.8
(%)	40	72	135	104	130
(MPa/kpsi)	1475 /214	1544 /224	1641 /238	1613 /234	1744 /253
(MPa/kpsi)	47.7 /6.92	34.5 /6.94	47.5 /6.89	48.0 /6.96	49.8 /7.23
(%)	—	5	11	9	18
[J/m(ft*lb/in)]	26.7 (0.5)	32.0 (0.6)	37.4 (0.7)	37.4 (0.7)	37.4 (0.7)
(%)	0	1.94	1.76	1.81	1.80

[5]

	1	2	1	2	3
PP(%)	100	91.80	94.80	94.80	94.80
MA-g-PP(%)		5.00			
285(%)			2.00		
220(%)				2.00	
65					2.00

(%)		3.00	3.00	3.00	3.00
(%)		0.20	0.20	0.20	0.20
2.16kg MFR(dg/10)		5.2			5.3
(MPa/kpsi)	36.2 /5.25	35.4 /5.14	36.5 /5.29	35.9 /5.20	34.7 /5.04
(%)	11.3	9.3	7.7	7.7	8.7
(%)	40	72	100	120	89
(MPa/kpsi)	1475 /214	1544 /224	1813 /263	1862 /270	1675 /243
(MPa/kpsi)	47.7 /6.92	47.8 /6.94	52.5 /7.61	52.5 /7.61	48.1 /6.97
(%)	—	5	23	26	14
[J/m(ft*lb/in)]	26.7 (0.5)	32.0 (0.6)	48.0 (0.9)	53.4 (1.0)	37.4 (0.7)
(%)	0	1.94	1.96	1.86	1.90

, EBS , 가

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5

가

, ASTM

1

6

PP, MA-g-PP, 1 . AC 656 PE 가 (drop point) 98
 , 140 185cps , 가 15 . AC 395 HDPE 가 137 , 150
 2500cps , 가 41 . AC 316 HDPE 가 140 , 150
 8500cps 가 16 . AC 645 PE/ EVA (<30%|>70%)
 (Honeywell)

[6]

	1	2	1	2	3	4
PP(%)	100	91.80	94.80	94.80	94.80	94.80
MA-g-PP(%)		5.00				
AC 656(%)			2.00			
AC 645(%)				2.00		
AC 395(%)					2.00	
AC 316(%)						2.00
(%)		3.00	3.00	3.00	3.00	3.00
(%)		0.20	0.20	0.20	0.20	0.20

(MPa/kpsi)	36.2 /5.25	35.4 /5.14	34.3 /4.97	34.9 /5.06	35.3 /5.12	35.6 /5.17
(%)	40	72	100	120	110	120
(%)	11.3	9.3	9.8	9.5	9.0	9.0
(MPa/kpsi)	1475 /214	1544 /224	1544 /224	1648 /239	1703 /247	1724 /250
(MPa/kpsi)	47.7 /6.92	47.8 /6.94	46.7 /6.78	49.1 /7.12	50.5 /7.33	50.7 /7.35
(%)	—	5	5	12	15	17
[J/m(ft*lb/in)]	26.7 (0.5)	32.0 (0.6)	32.0 (0.6)	3.74 (0.7)	3.74 (0.7)	3.74 (0.7)
(%)	0	1.94	1.74	1.78	1.76	1.78

6

, , 4 .
 , PP, ASTM , EBS 1 1 (Nanocor Inc.) (Nanocor) PGW 7

[7]

		1	2
PP(%)	100	94.80	94.80
EBS(%)		2.00	3.00
(%)		3.00	
PGW(%)			2.00
(%)		0.20	0.20
(MPa/kpsi)	36.2/5.25	35.4/5.14	34.7/5.03
(%)	11.3	7.7	9.0
(%)	40	123	85
(MPa/kpsi)	47.7/6.92	51.4/7.46	49.2/7.13
(MPa/kpsi)	1475/214	1806/262	1682/244
[J/m(ft*lb/in)]	26.7 (0.5)	58.7 (1.1)	58.7 (1.1)
(%)	0	1.79	1.18

1 , 가 , EBS 가 EBS

7 , SMS (LLDPE)

8 177 (350), 200 600rpm 40mm 2 5oz AST
 M 32 (90), 12.7mm/sec(0.5in/sec) 8

1 . LLDPE가 -1 ,
 (Daelim Industrial Co., Ltd) . SMS 4
 . AC 575 / (Honeywell)

[8]

	1	2	3	4
LLDPE(%)	100	95.80	91.80	91.80
AC 575			4.00	
SMS(%)				4.00
(%)		4.00	4.00	4.00
(%)		0.20	0.20	0.20
(MPa/kpsi)	15.6/2.26	13.6/1.97	15.1/2.20	14.5/2.10
(%)	500+	450	500+	500+
(MPa/kpsi)	282/40.9	323/46.8	322/46.7	324/47.0
(MPa/kpsi)	0.7/1.55	11.7/1.70	12.1/1.75	11.7/1.69
(%)	—	14	14	15
(%)	—	2.22	2.39	2.42

가 , 2 3 1

가 , 가

1. (iv) , - (i), (ii), - (iii)
(a) 1:3 , (b) , , (intercalation agent)
- 1 2. , (a) , .
- 1 3. , (a) , .
- 1 4. , (a) C₄ - C₈ - , .
- 1 5. , (b)가 , .
- 1 6. , 가 - , .
- 6 7. , - 가 , .
- 6 8. , - 가 , .
- 6 9. , - 가 , .
- 1 10. , 가 , .
- 10 11. , 가 - , .
- 1 12. , 가 - , .
- 12 13. , 가 , .
- 1 14. , 가 , .
- 14 15. , , .
- 14 16. , / , .

