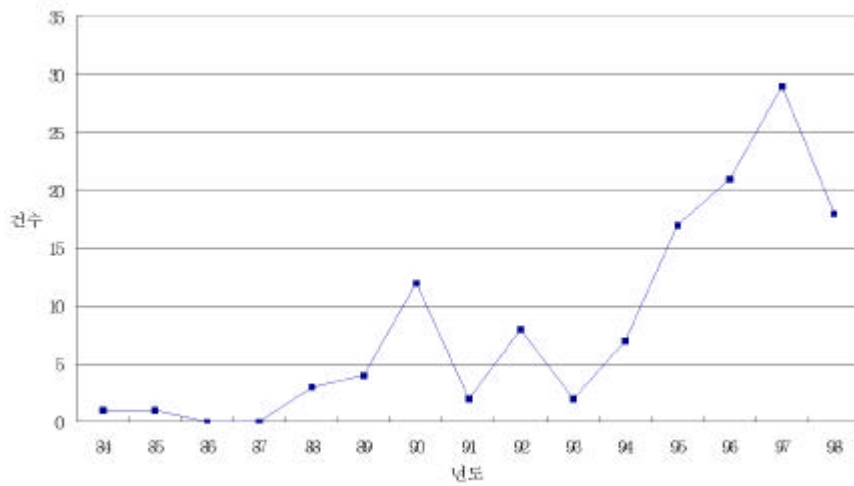


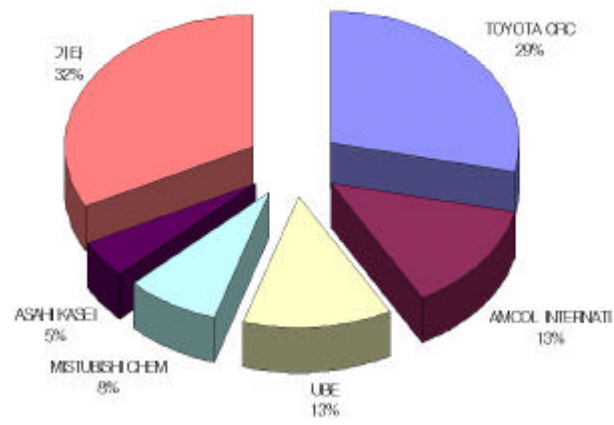
## 5. 가

5-1.

가 94, 가 95, 가 90, 가  
 , 가 가 가  
 . TOYOTA CRC가 1, AMCOL  
 INTERNATIONAL, UBE, MITSUBISHI CHEM. ASAHI KASEI  
 5 68% .



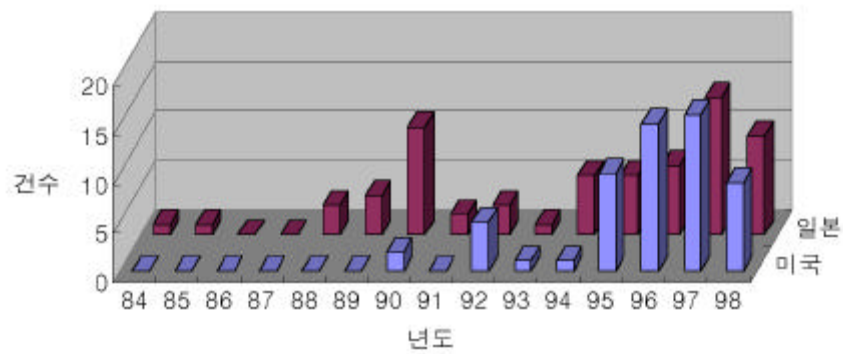
3-34. 가



3-35.

5-2. 가

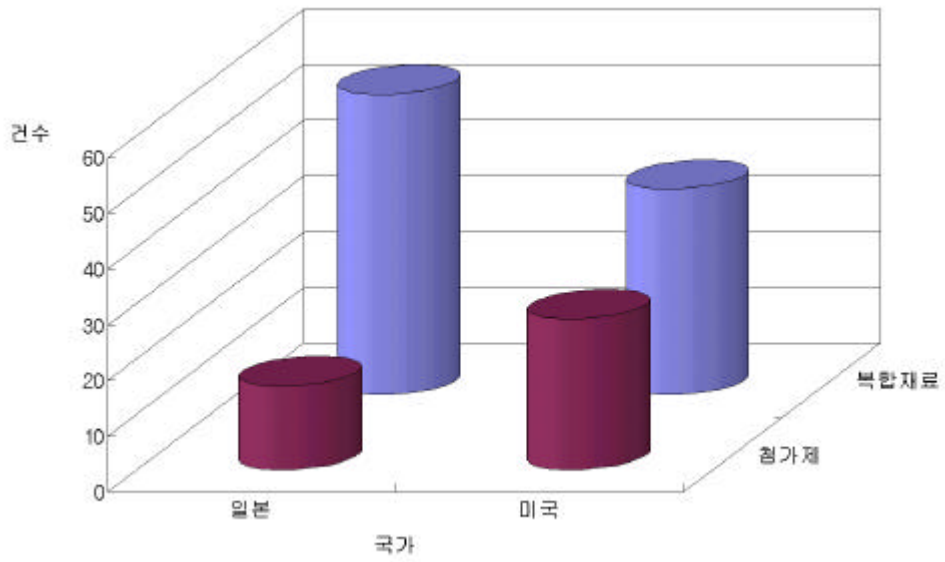
90  
 , 90  
 가 97 . 6



3-36. 가 가

5-3.

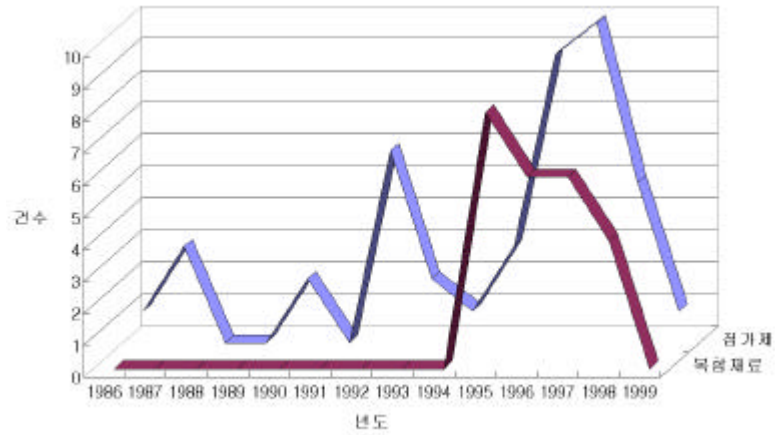
Clay 가  
가  
가  
가  
AMCOL 가



3-37. 가

5-3-1.

가  
가



3- 38. 가

가 Amcol, Allied signal  
 Inc, Michigan State University, Claytec, Inc., Cornell Research Foundation,  
 Inc., Toyota Chuo Kenkyusho, Showa Denko K.K., Southern Clay  
 Products , Amcol 가 1 2  
 Nano Composite Clay Amcol  
 . Amcol Toyota License Clay  
 Modification  
 . Cornell Research , Michigan  
 Epoxy-Clay System Polymer-Clay

### 3-3. Modified Silicate

US5514734	1995-07-10	Polymer	Allied signal inc.
US5530052	1995-04-03	1) heteroaromatic cation + heteroatom Layered mineral	General Electric company
US5554670	1994-09-12	Alkyl ammonium salt Layered silicate epoxy	Cornell Research Fndation, inc.
US5634969	1995-11-03	4 Ammonium slat PPG, DEG, hexylene Glycol Clay	Rheox, Inc.
US5707439	1995-12-18	Layered minerals and compositions comprising the same	General Electric
US5780376	1997-02-20	Organoclay compositionso	Southern Clay Products, Inc.
US5824226	1997-02-03	Silane-modified clay 15% volatile matter, porosity 0.3ml/g caly silane	Loyola University of Chicago

Clay 가

Clay

Amcol

### 3-4. Amcol Clay Modification

Intercalates and exfoliates form: oligomer polymer	US5552469	1996-09-03
oligomers polymer 2~15% layer 10 Å exfoliated layered material 0.05%~40% composite	US5698624	1997-12-16
Intercalates : solvent(10 ~ 99.5%) solvent Polymer (aromatic ring, carbonyl, hydroxyl, amine, amide )	US5721306	1998-02-24
solvent oligomers polymers (polymer 16%~100%) Intercalates and exfoliates form : 10 Å	US5760121	1998-06-02
Intercalates exfoliates form : carbonyl- functional (carboxylic and polycarboxylic acids; aldehydes; ketones ) spacing 5 Å	US5804613	1998-09-08
oligomers polymer Intercalates and exfoliates form; 80% 5 layer	US5837763	1998-11-17
Intercalates and exfoliates form 가 monomers, oligomers, polymers (non- EVOH) Intercalates and exfoliates form ( 5 Å ) EVOH 가(0.05 wt% ~ 60 Wt%)	US5844032	1998-12-01
N- alkenyl amide, Allylic monomer oligomers copolymers 2% 10 Å Intercalates and exfoliates form , composite materials	US5849830	1998-12-15
amines, amides Intercalate form 5 Å 가 5 %	US5880197	1999-03-09
polymer-grade clay : Clay	US6050509	2000-04-18

Clay Intercalate Exfoliate

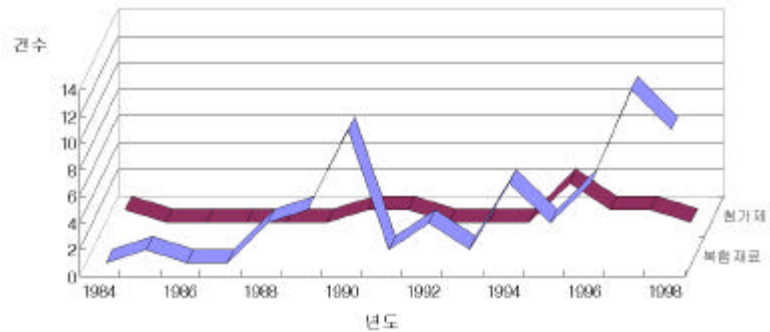
Intercalate

Amcol Coupling Agent

가 , 가 ,  
 . grade  
 Melt Process 1990  
 , 1990 가

5-3-2.

가 가 가 ,



3-39. 가

1970

가

1975

US 4739007( 62-74957,  
 1985.9.30)가

Layer

Layer

1975 Bayer

Grace  
Silica

가

Fine Powder  
US 4176090 Modified

5164460, US 5206284

Polyamide

US 4810734 US



### 3-5. Polyamide

JP 1990- 29457	UBE, Toyota Motor, Toyota CRL	Polyamide + layered silicate as impact improver	
JP 1990- 305828	UBE, Toyota Motor, Toyota CRL	Polyamide Monomer swelling layered silicate	
JP 1990- 208358	UBE, Toyota Motor, Toyota CRL	Polyamide + layered silicate	
JP 1990- 10226	UBE, Toyota Motor, Toyota CRL	Polyamide + layered silicate	가
JP 1991- 081364	UBE, Toyota Motor, Toyota CRL	Polyamide Monomer swelling layered silicate	
JP 1992- 209844	Toray	Layered silicate polyamide	fiber
JP 1995- 242817	SHOWA DENKO	"	"
JP 1996- 169950	UNITIKA	가 Layered silicate	
JP 1998- 298426	Asahi Chem	Polyamide Resin Layered silicate	melt - mixing
JP 1999- 217497	Asahi Chem	Polyamide Resin Layered silicate	
JP 1999- 209606	Asahi Chem	Polyamide Resin Layered silicate	
JP 1999- 199770	Asahi Chem	Polyamide Resin Layered silicate	
JP 1999- 172100	UNITIKA	Polyamide Resin Layered silicate	

1988

(Kabushiki Kaisha Toyota Chou Kenkyusho), UBE  
Polyamide-Clay Polyamide

Clay

1995

(Kabushiki Kaisha Toyota Chou Kenkyusho)

Polyamide

. Unitika, Toray, Asahi, Kanegafuchi,  
Mistubishi Polyamide  
. 1990 Polayamide  
Polyester Modifictaion Clay 가

3-6.

POLYMER	
Polycarbonate	JP1995-228762, JP1998-60160 (Mistubishi Chem)
Polyolefine	JP1998-182892 (Toyota CRL ) JP1998-30039 (Showa Denko ) US5955190(1997 : Estman Kodak)
POLYESTER	JP1995-166036 (Mistubishi Chem) JP1999-130951 (UNITIKA) JP1999-246748 (Toyobo) US 6034163 ( 1998 :Eastman Chem ) US 5773502 ( 1995 : GEneral Electric)
Polyacetal	JP 1999-246736 (POLYPLASTIC)
Polyarylene Sulfide	JP 1993-194851 (Tosho Corp)
PMMA	JP 1999-71465 (Toyota CRL)
Fluoro Polymer	US 5840796 (1997: Xerox)
Thermosetting resin	JP1998-259016 (Toyota CRL)
EPOXY	US5801216 ( 1997: Michigan State University ) US5554670 ( Cornell Research Foundation Inc )
TPE	US 5652284 ( Exxon :)

\* : ( )

Polyester

가

. Epoxy

3-7. Polyamide

Nanocomposite

JP1997-143359	Kanegafuchi Chem	Polycarbonate PET + layered silicate	
JP1996-333475	Kunime Kogyo kk	Resin Swellable layered silicate	
JP1996-199048	Mitsubishi Chem	PP PET + layered silicate	
JP1995-151165	Mitsubishi Chem	PPE layered silicate	
JP1995-228762	Mitsubishi Chem CO_OP Chem	Polycarbonate layered silicate	Compounding
JP1995-166036	Mitsubishi Chem CO_OP Chem	Polyester layered silicate	
JP1993-194851	Tosho Corp	Polyarylene Sulfide	
JP1999-71465	Toyota CRL	PMMA layered silicate + Monomer	
JP1998-330535	Toyota CRL	Thermosetting resin layered silicate	
JP1998-259016	Kanegafuchi	Thermoplastic resin layered silicate	
JP1998-182892	Toyota CRL	polyolefin clay	melt kneading

Kanegafuchi, Kunime Kogyo, Mitsubishi Chem, CO\_OP Chem Toyota  
CRL Nanocomposite, Modified Silica

1993 ( ) Tosho 가

CO\_OP Chemical, Sowa Denko

1999 , 가 Composite 가

.

Composite System 가 가

Showa Denko, Kanegafuchi Clay Modification

, Mistubishi Chemical Filler Co-Op Chemical

, Toyota

5-3-3.

가

1997

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가

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. 1998

가

2000

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(

10- 2000- 3711)

가

3-8.

10-2000-3711	/
10-2000-16466	/
10-2000-18215	
10-2000-37082	-
10-2000-7007572	
10-2000-7007573	
10-2000-40961	-
10-2000-7008904	
10-2000-48493	-
10-2000-52689	
10-2000-7010179	
10-2000-58276	
10-2000-7011613	