

<PU >

MDI · TDI

PU “ ”

(PU)
 가 PU

 CFC ,
 PU
 PU MDI , TDI 2 , MDI
 PU , PU
 가 가 ,

 , 가
 가 ,
 , Solid Urethane Plastic, .
 . ()
 (.) 가

 . MDI TDI 가 가
 PU (TDI · MDI) , TDI .
 , MDI
 TDI 78 2 5000 ,
 5 가 , 2 5000 .
 TDI Allied Signal (?) , 가
 가 , 5
 50% 가 , 93 가 ,
 5 MDI 92 TDI 3 7000 .
 MDI 2 , Bayer
 가 5 가 2 , 가
 .
 6 4 , 가 ,
 9 가 .
 MDI 92 4 8 , 2
 .
 PPG SANYO KASEI , 74 가 , 5
 Dow 2 , Arco ,
 2 .

< 1> PU

(:)

T D I			20,000 25,000	78 가 , 92 가 , Allied Signal	
			45,000		
M D I			20,000 40,000 20,000	92 7 , BASF , Misui Toatsu	
			80,000		
PPG	Polyether		50,000 20,000 (20,000) 20,000	74 가 , Sanyo Kasei 90 가 , Dow 91 가 , Arco Chem	
			90,000		
		Polyster		8,000 7,500 4,500 4,000 4,000 1,500	
				29,500	

< 2> Polyurethane 가

		가
Polyurethane Foam		Slab Stock, Mold , Sheet Roll
		Slab Stock, Mold
		Slab Stock, Mold , Lamination,
	RIM	(RIM)
Polyurethane Elastomer		Conventional, , ,
		(混練)
	가 (TPU)	, , Calender, ,
Solid urethane plastic	—	, Coating
.	—	Coating, Calender (,)
()	—	,
	, Resin Concrete, Sealant Coking ,	가 가
	1 , , ,	,
	2 Polyisocyanate/ polyol ,	
	1 Polyisocyanate , Prepolymer , Emulsion ,	Roll, ,
	2 Polyisocyanate/ polyol ,	

< 4> Slab Foam

(: /)

		TDI	POLYO
P U F	"	120	L
		150	200
		180	250
		350	300
		150	600
KPU 1		100	250
		150	150
		100	250
KPU 2		150	150
KPU 3		1,450	250

PPG 92
10

가 6 6200

가 PO

PPG

Dow

PPG

TDI

, Pure MDI

, Polymeric MDI

PPG

가

< 3> PU (1992)

(:)

	POLYOL			ISOCY ANATE				
	PPG	Polyeste	PTHF	TDI	PMDI	MMDI	Prepolyme	
FLEXIBLE FOAM	42,900	r	—	19,600	500	0	r	63,900
Slab stock foam	26,000	—	—	15,000	—	—	900	41,000
Mold foam	11,600	—	—	4,500	500	—	—	17,400
가	400	—	—	100	—	—	800	600
	4,900	—	—	—	—	—	100	4,900
SEMI-RIGID FOAM	2,900	—	—	—	1,000	—	—	4,500
EA foam	900	—	—	—	—	—	600	1,500
	2,000	—	—	—	1,000	—	600	3,000
INTEGRAL SKIN FOAM	2,400	—	—	—	—	5,500	—	21,300
가	800	11,800	—	—	—	—	1,600	1,150
	100	—	—	—	—	—	350	150
Shoe sole	—	—	—	—	—	5,500	50	17,700
RIM	1,500	11,800	—	—	—	—	400	2,300
RIGID FOAM	14,000	—	—	—	20,000	—	800	34,000
	7,000	—	—	—	10,000	—	—	17,000
	1,750	—	—	—	2,500	—	—	4,250
	1,750	—	—	—	2,500	—	—	4,250
	1,400	—	—	—	2,000	—	—	3,400
	2,100	—	—	—	3,000	—	—	5,100
	4,000	—	8,500	6,000	2,500	6,000	—	44,300
	—	17,300	500	4,000	—	3,400	—	24,400
	—	16,500	8,000	—	—	2,000	—	10,000
T P U	—	—	—	—	—	200	—	1,000
	4,000	800	—	2,000	2,500	400	—	8,900
	66,200	—	8,500	25,600	24,000	11,500	—	163,100

가

< 7> PU

(:%)

	1990	1991	1992	1993	1994	1995
Domestic	12	13	15	16	18	20
Commercial						
Cars	1.3	1.6	2	2.3	2.7	3.2
Commercial						
M-CYCLES	0.28	0.37	0.48	0.62	0.8	1
BICYCLES	1.5	1.55	1.62	1.7	1.78	1.85
Casual	0.15	0.16	0.17	0.18	0.18	0.18
Sports	0.3	0.31	0.3	0.28	0.3	0.3
Work	0.15	0.15	0.16	0.15	0.17	0.19
Avg % PU	15	13	13	13	13	13
1	16	20	15	12	10	10

) CASE Factor

< 5> PU

	1987	1989	1991	1993	1995	(%)	
						(87~91)	(91~95)
(1000SET)	2,624	3,163	3,400	3,900	4,200	6.70	5.40
(1000TEU)	2,500	14,100	17,900	21,000	25,600	63.60	9.40
(1000SET)	966	1,099	1,370	1,710	2,136	9.20	11.70
Shoe Sole(Millio, Pairs)	525	629	892	888	1,055	14.30	4.40
(Km)	2,900	4,500	5,300	6,100	7,100	6.20	7.90
()	400	1,100	2,000	2,600	3,000	49.60	10.70

< 6> PU (CASE)

(:1000 , %,)

	1991	1992		1993		1994		1995	
Slab Stock	40.1	41.0	2.2	42.7	4.1	45.6	6.8	48.3	5.9
	16.9	17.0	0.6	19.5	14.7	22.3	14.4	24.8	11.2
	23.0	25.4	10.4	27.9	9.8	30.3	8.6	32.9	8.6
	11.3	13.8	22.1	16.1	16.7	17.8	10.6	19.0	6.7
	4.0	4.3	7.5	4.8	11.6	5.4	12.5	6.1	13.0
	59.4	53.1	10.6	54.2	2.1	56.9	5.0	61.3	7.7
	5.2	8.5	63.4	10.2	20.0	11.7	14.7	13.2	12.8
	159.9	163.1	2.0	175.4	7.5	190.0	8.3	205.6	8.2

) CASE 6.5%

()

3000

3

TDI

6000 ~ 7000(3)

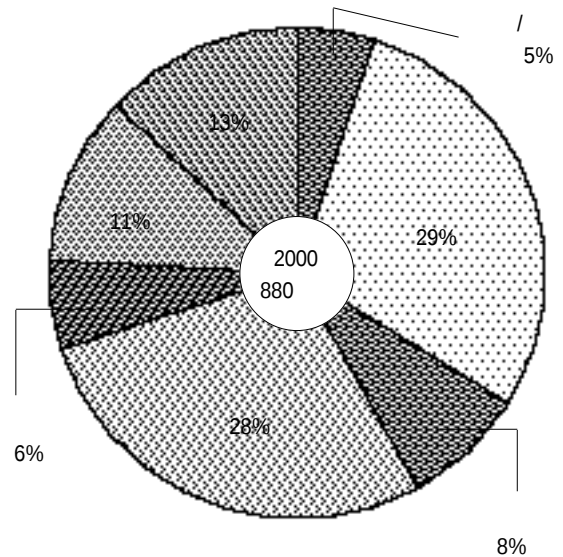
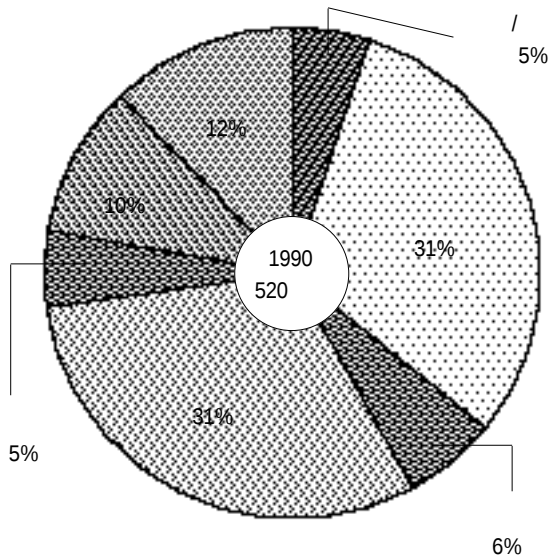
TDI

Polymeric MDI

(Cold

Foam)

< 1> PU



< 8> MDI PU (CASE)

(: , %,)

	1989		1990		1991		1992		1993		1994		1995	
A P P L	17,000	20.0	18,000	5.88	20,000	11.1	22,000	10.0	24,500	11.3	26,000	6.12	28,000	7.69
	10,000	15.0	12,000	20.0	13,000	8.33	14,000	7.69	15,000	7.14	17,000	13.3	19,000	11.7
	9,000	15.0	10,000	11.1	10,000	0	9,000	10.0	8,000	11.0	8,000	0	8,000	0
T P U	600	—	800	—	5,000	—	5,000	—	7,000	—	7,000	—	7,000	—
	8,400	—	9,200	—	10,200	—	11,100	—	12,100	—	13,000	—	13,900	—
가	1,000	15.0	1,400	40.0	1,600	14.2	1,800	12.5	2,000	11.1	2,300	15.0	3,500	52.1
	15,000	23.0	15,000	0	17,000	13.3	18,500	8.82	20,000	8.10	22,000	10.0	24,000	9.09
C A S E	5,000	20.0	7,000	12.5	8,400	20.0	9,700	15.4	11,000	13.4	12,700	15.4	14,000	10.2
Synthetic	3,000	—	5,000	—	5,400	—	6,200	—	6,200	—	7,600	—	8,500	—
	2,000	—	2,000	—	3,000	—	3,500	—	4,400	—	5,100	—	5,500	—
	3,000	20.0	4,600	53.3	5,000	8.69	5,000	0	5,500	10.0	6,000	9.09	7,500	25.0
	63,000	20.0	70,000	11.1	75,000	7.14	80,000	6.66	86,000	7.5	94,000	9.30	104,000	10.6

TDI PMDI

92

6 3900

, PPG 4 2900 , TDI 1 9600 ,

PMDI 500 , Prepolymer 900

, TDI가 93.3%

Slab Stock Foam TDI

PPG 2 6000 , TDI 1 5000

4 1000

Mold Foam

가

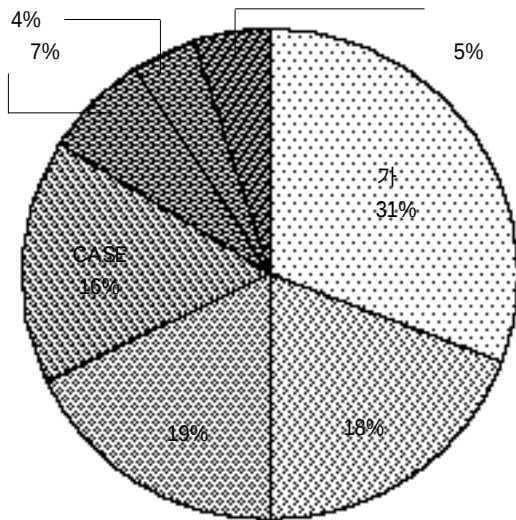
PPG 1 1600 , TDI 4500 ,

PMDI 500 , Prepolymer 800

1 7400

가 PPG 400 , TDI 100 , Prepolymer 100 600 ,
 가 TDI MDI가
 , 가
 3 (6000)
 MDI Polymeric MDI가 TDI

< 2> PU



92 6 3900
 PPG 4 2900 · TDI 1
 9600
 PPG 2900 ,
 PMDI 1000 , Prepolymer 600
 4500
 EA Foam PPG 900 ,
 Prepolymer 600 1500
 PPG 2000 , PMDI
 1000 3000
 PVC
 가

Sole · RIM 4 92
 1 1800 , MMDI 5500 , Prepolymer 1600

2 13 00 PPG 2400
 PPG 800 · Prepolymer 3500

가 PPG 100 · Prepolymer 50 , Shoe Sole
 Prepolymer 400 , RIM PPG 1500 · Prepolymer 800
 4500

Polyester 1 1800 · MMDI 5500

2 1300

3

가

Polymeric MDI Crude MDI

Rigid Foam

3 4000

PPG 1 4000 , PMDI 2

PPG 7000 · PMDI 1 1 7000 , PPG 1750 ·
 PMDI 2500 4250 , PPG 1750 · PMDI 2500 4250 , PPG
 1400 · PMDI 2000 3400 , PPG 2100 · PMDI 3000 5100

TPU (PTMEG ·
 PPG · PEG) MDI(TDI · XDI) ,
 (PTMEG ·) Pure MDI, , Hydrazinehydrate

1 6500 , PTMEG 500 · TDI 4000 · MMDI 3400
 2 4400 PTMEG 8000 · MMDI 2000 1
 , TPU 800 , MMDI 200 1000

92 3 4000 1 7000 4250
 PU 6 3900 , 4500 , 2 1300 ,
 3 4000 , 4 4300 16 3100
 PPG 6 6200 , 2 9100 , PTMEG 8500 10 3800
 TDI 2 5600 , PMDI 2 4000 · MMDI 1 1500 · Prepolymer
 3100 MDI 3 8600
 ()
 가
 RIM,

< 9> TDI PU (CASE)

(: . %)

	1989		1990		1991		1992		1993		1994		1995	
가 C A S E	8,000	10.0	9,000	12.5	10,000	11.1	11,000	10.0	12,200	10.9	13,500	10.6	15,000	11.1
	27,000	6.0	29,200	8.1	31,000	6.2	33,400	7.7	35,500	6.3	38,100	7.3	41,500	8.9
	10,500	7.0	11,000	4.8	12,000	9.1	13,000	8.3	14,500	11.5	15,200	4.8	16,000	5.3
	500	7.0	800	60	1,000	25.0	1,600	60.0	1,800	12.5	2,200	22.2	2,500	13.6
	46,000	—	50,000	8.69	54,000	8.0	59,000	9.3	64,000	8.1	69,000	7.8	7,5000	8.7

< 10> PU (CASE)

(: , %,)

	1989	1990		1991		1992		1993		1994		1995	
A P P L 가 C A S E	17,000	18,000	5.88	20,000	11.1	22,000	10.0	24,500	11.3	26,000	6.12	28,000	7.69
	10,000	12,000	20.0	13,000	8.33	14,000	7.69	15,000	7.14	17,000	13.3	19,000	11.7
	9,000	10,000	11.1	10,000	0	9,000	10.0	8,000	11.0	8,000	0	8,000	0
	9,000	10,400	15.5	11,600	11.5	12,800	10.3	14,200	10.9	15,800	11.2	18,500	17.0
C A S E	42,000	44,200	5.23	48,000	8.59	51,900	8.12	55,500	6.93	60,100	8.28	65,500	8.98
	18,500	20,000	8.10	20,400	2.0	22,700	11.2	25,500	12.3	27,900	9.41	30,000	7.52
	3,500	5,400	54.2	6,000	11.1	6,600	10.0	7,300	10.6	8,200	12.3	10,000	21.9
	109,000	120,000	10.0	129,000	7.5	139,000	7.75	150,000	7.91	163,000	8.66	179,000	9.81

92 PU 16 3100 MDI 3 8600 · TDI 2 5600
 가 , 87 262 4000 89 316 3000 , 91 340
 87~91 6.7% , 93 390 , 95 420 93~95 5.4%
 ,
 PU 92 1 7000 (PPG 7000 · PMDI 1)
 , 0.6% 가

PU 93 1 9500 14.7% 가 ,
 94 2 2300 14.4% , 95 2 4800 11.2% 가가 .
 PU 4.5kg 가 . 87 96 6000 89 109 9000 , 91
 137 87~91 9.2% 가 , 91 93 171 , 95 213
 6000 91~95 11.7% 가 , 가
 가 가
 7 가 79 7984 17.6%
 가 , 60 9600 . 18 8384 19.6% · 11.6% 가
 .
 PU 가 , , .
 가, RIM , RIM, R · RIM,
 RIM R · RIM, RIM 가 , PU
 Mold Foam 1 7400 , 1150 , RIM 2300
 2 5400 가 .

< 11> PU (CFC)

	Formula	Molecular Weight	Boiling point()	Flammability (limits%)	Thermal conductivity	ODP	GWP	Commercial availability
CFC11	CCl ₃ F	137.4	23.8	None	0.008	1.0	1.0	Yes
CO ₂	CO ₂	44.0	-79.8	None	0.017	0	NA	Yes
HCFC22	CHClF ₂	86.5	-40.8	None	0.011	0.05	0.3	Yes
HCFC123	CF ₃ CHCl	152.9	27.9	None	0.013	0.02	0.02	Trials
HCFC141b	CCl ₂ FCH ₃	117.0	32.0	7.3~16	0.009	0.15	0.09	Trials
HCFC142b	CH ₃ CClF ₂	100.5	-9.8	6.7~14.9	0.013	0.06	0.5	Trials
HFC134a	CF ₃ CH ₂ F	102.0	-26.5	None	0.015	0	0.3	1992
HFC152a	CH ₃ CHF ₂	66.0	-24.7	3.9~16.9	0.015	0	5.0	—
LBL2	CH ₃ CHClCH ₃	NA	34.8	NA	—	0.003	0.01	Yes

< 12> PU

(: /1)

	1990	2000	1
	1.6	2.6	
	0.3	0.7	
	0.3	0.4	
	2.2	3.7	5.3%
	1.5	2.3	
	0.1	0.2	
	0.2	0.4	
	0.1	0.1	
	1.9	3.0	4.7%
	0.5	1.0	
	0.1	0.3	
	0.1	0.2	
	0.1	0.1	
	0.1	0.1	
	0.2	0.4	
	1.1	2.1	6.7%
	5.2	8.8	5.4%

92 2 5400 91 10.4% 가 , 93 2 7900 9.8%, 94 3 3000 8.6%,
 95 3 2900 8.6% 가가 .
 PU , ICI가 MDI PU

, PU 60% ,
 91 12 ~ 14kg , 17 ~ 18kg
 RIM 가 PP 가 TPU
 HR

91~95 가 11.7% PU14% 가
 87 ~ 91 가 63.0% 87 250 , 89 1410 , 91 1790 가
 93 2100 , 95 2560 9.4% 가
 , St-eel PU 가
 4250

91 7.5% 가
 93 48 00 92 11.6% 가 , 94 5400 12.5%, 95 6100 13.0% 가
 가
 가
 Bayer MDI

가 PU 11~13% 가
 PUF ,
 PU

가 PU 가가

PU 92 1 3800 22.1% 가 , 93 1 6100 16.7%, 94
 1 7800 10.6%, 95 1 9000 6.7% 가가 , 가
 4250 , 3400 , 5100 가
 2

PU 가 , Dealer 가
 Unknown System House가

, 가 PU , 가
 PU 가 가

, 가 Mold Foam 600 , Integral Skin Foam 150
 가 가 가 가
 ICI가

90 75.4% 가 ,
 가

87 5 2500 , 89 6 2900 , 91 8 9200 87~91
14.3% 가 , 93 8 8800 91 , 95
10 5500 91~95 가 4.4% 가 .

92 PU 1 3800
PU 92 5 3100 10.6%
, 93 5 4200 2.1%, 94 5 6900 5.0%, 95 6 1300 7.7% 가 .
Shoe Sole 1 7700 .
PU 가 PU 가

MDI , Dow Self Formulator PU ,
Lab MDI PU 가
MDI , 가
PU Dow (MDI) , PU
ICI

Arco PPG

92 PU 5 3100 10.6%

HCFC 123 141b가
, R-22

가 .

가 ,

-50 ~ +130 , 160 가
200 解重合性 , RIM 200

PU PU 가