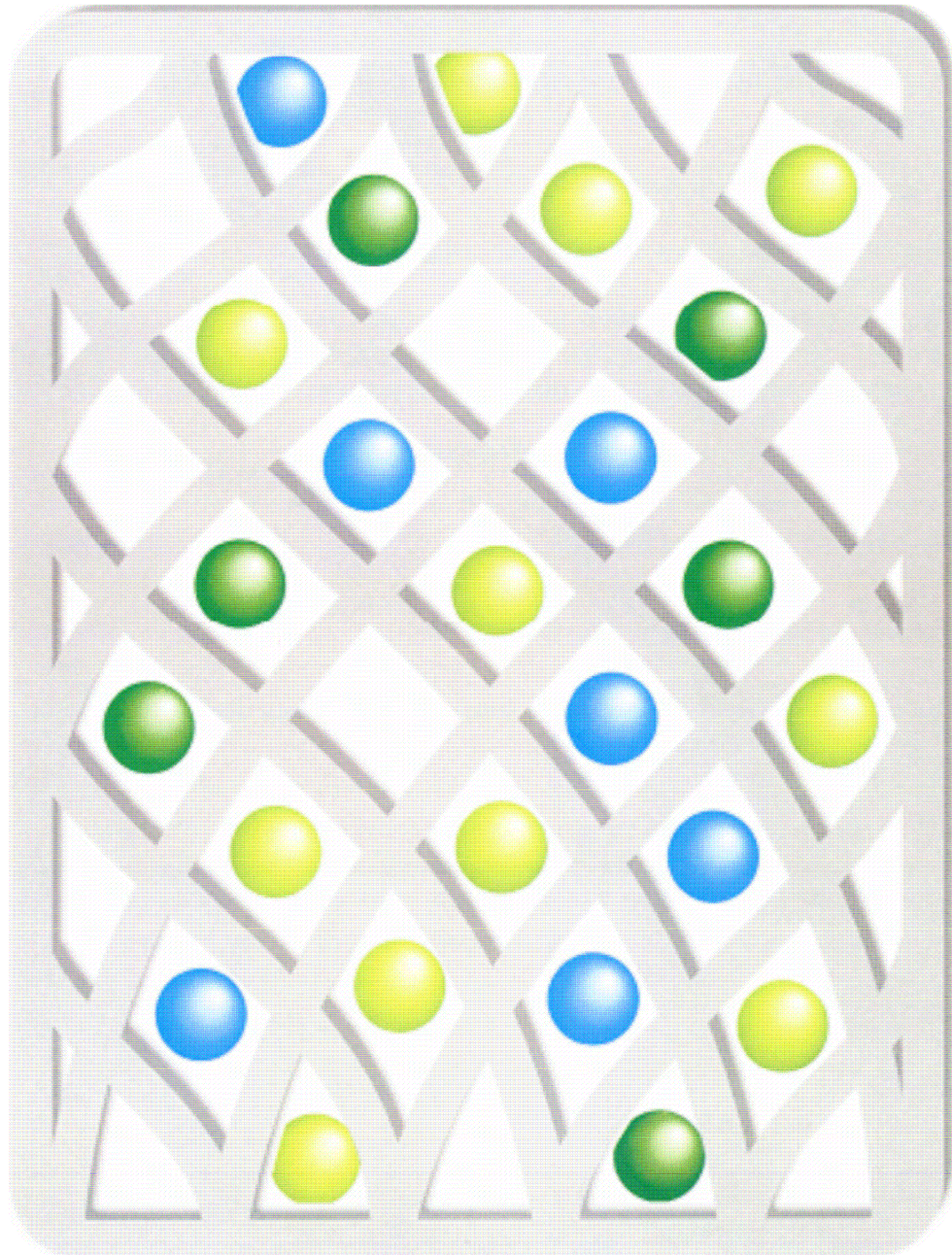


Thermoplastic Polyurethane Elastomer

Kuramiron™



kuraray

What is <Kuramiron™>

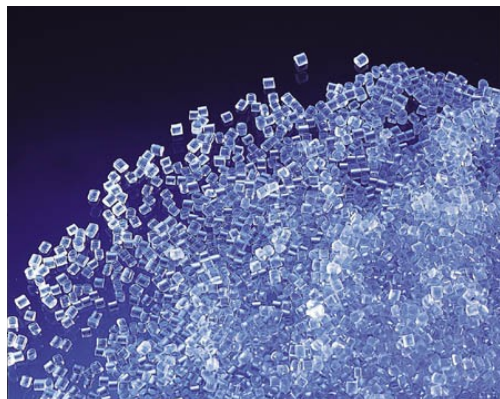
Kuramiron™ is a thermoplastic polyurethane elastomer (TPU) developed by Kuraray Co., Ltd. using its unique raw material and technology. Therefore we believe that Kuramiron™ can contribute to customer's new business developments.

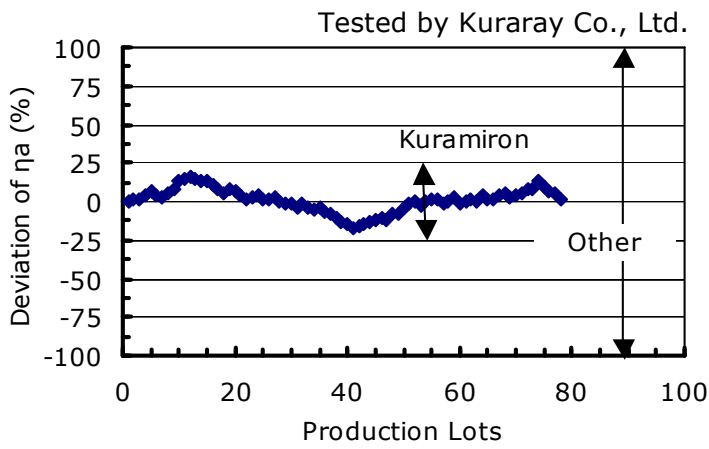
The Features of Thermoplastic Polyurethane

- (1) Good abrasion resistance
- (2) Excellent mechanical properties
- (3) Excellent oil resistance
- (4) Good compatibility with other polymers
- (5) Good ozone resistance
- (6) Good transparency
- (7) Recyclability

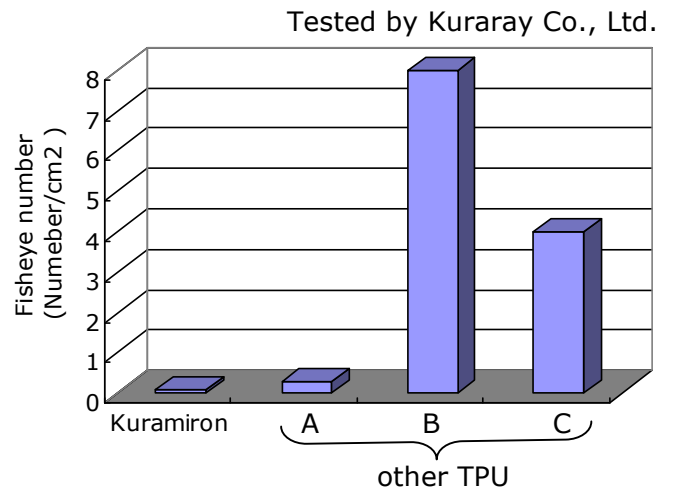
The Features of <Kuramiron™>

- (1) Excellent uniformity of melt viscosity among lots
- (2) Low fisheye level
- (3) Soft TPU (65A) without oil is available. [#8000 series]
- (4) Soft TPU (60A) having low density and good injection moldability is available. [#A series]
- (5) Good water resistance [#3000, #8000, 9000 series]
- (6) Excellent adhesion to polar resins like ABS [#3000, #8000, #A series]

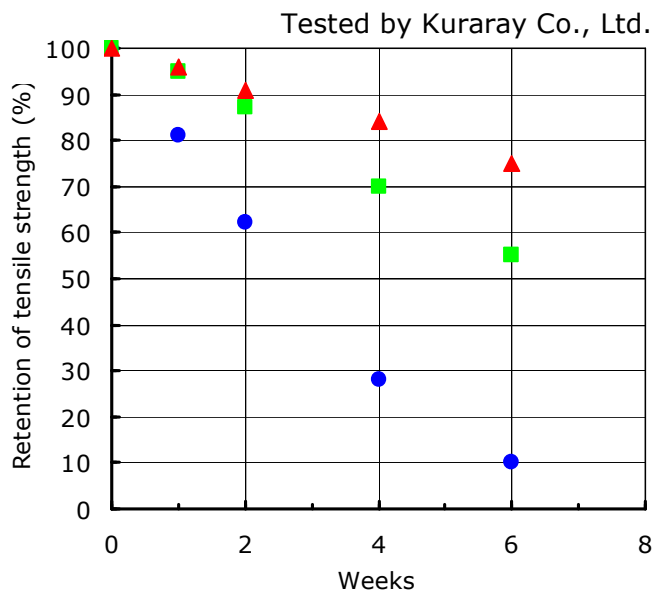




Melt viscosity uniformity comparison between Kuramiron™ and other TPU

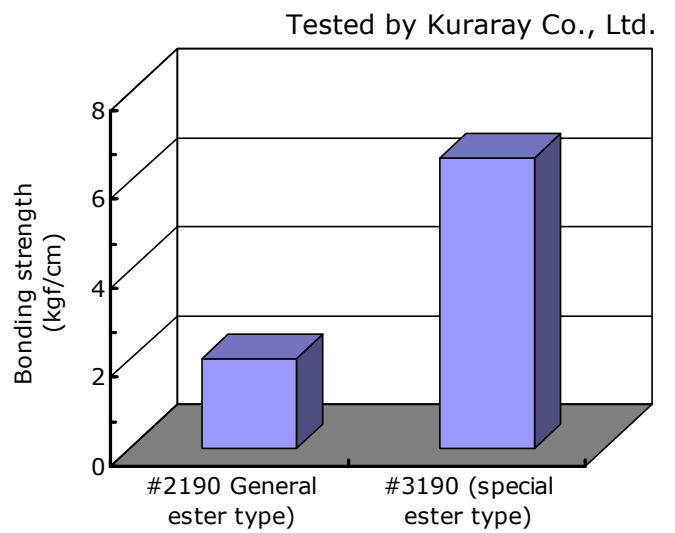


Fisheye level comparison between Kuramiron™ and other TPU



Water resistance comparison

- ▲: #9190 (general ether type)
- : #3190 (special ester type)
- : #1190 (general ester type)



Adhesion to ABS comparison

Line-up of <Kuramiron™>

Type	Series	Hardness range	Features
[General type]			
Ester	#1000	80 – 95	(1), (2)
	#2000	85 – 95	(1), (2)
Ether	#9000	75 – 95	(3), (5), (7)
[Special type]			
Special ester	#3000	80 – 95	(1), (3), (4), (8)
	#8000	65 – 80	(4), (5), (6), (8)
Special ether	#A	60 – 75	(3), (6), (7), (8)

(1): High tensile strength, (2): Good heat resistance, (3): Good water resistance
 (4): Excellent stain resistance, (5): Good low temperature properties,
 (6): Good flexibility, (7): Mildewproof, (8): Excellent adhesion to polar resins

Application of <Kuramiron™>

Application / Series	#1000	#9000	#3000	#8000	#A
[Extrusion]					
(1) Films; Sheets; Belts	Blue	Blue	Red	Red	Red
Stretching film				Red	Red
(2) Hoses; Tubes	Blue	Blue	Red		
Flexible tubes				Red	Red
(3) Coverings	Blue	Blue	Red	Red	Red
(4) Profiles					Red
(5) Cables; Wiring		Blue			
(6) Adhesive; laminate		Blue	Red	Red	
[Injection]					
(1) Grips; Straps	Blue	Blue	Red	Red	Red
Soft Grips				Red	Red
(2) Mechanical Engineering	Blue	Blue	Red	Red	Red
(3) Sports and Leisure	Blue	Blue	Red	Red	Red
[Modifiers, Additives]					
(1) Modifiers; Additives			Red	Red	

Typical Properties of #1000 Series

The typical properties of #1000 series (general ester type) are as follows.

Tested by Kuraray Co., Ltd.

Properties	Type	General Ester Type			Method
	Grade	1180	1190	1195	
Density	g/cm ³	1.19	1.20	1.21	ISO1183
Hardness (Shore A)	—	80	90	95	ISO7619
100% Modulus	MPa	4	6	10	ISO37
300% Modulus	MPa	6	10	20	
Tensile Strength	MPa	41	56	60	
Elongation	%	600	545	505	
Tear Strength	kN/m	69	105	164	ISO34
Impact Resilience	%	60	40	35	Luepke
Permanent Set	%	9	11	15	(* 1)
Compression Set (70 °C)	%	60	55	55	ISO815
Taber Abrasion (H-22)	mg	5	15	25	ASTM D1044
Tg	°C	-37	-32	-21	(* 2)
Vicat Softening Point (1 kg)	°C	60	88	109	ISO306
Flow Temperature	°C	123	161	180	Flow tester (* 3)
Melt Viscosity	200 °C	kPa·s	0.9	1.3	
	210 °C	kPa·s		—	—

< Measurement Conditions >

(* 1) Permanent set

Tension: 300 %, Holding time: 60 sec, Temp.: 23 °C

(* 2) Tg

Viscoelasticity measurement equipment (DVE-V4)

Tensile Mode, Heating Rate: 3 °C/min., Frequency: 0.1 Hz

(* 3) Flow tester

(3-1) Flow temperature

Nozzle shape: 1 mm ϕ × 10 mmL, Load: 100 kgf, Temp. rise speed: 5 °C/min

(3-2) Melt viscosity

Nozzle shape: 1 mm ϕ × 10 mmL, Load: 50 kgf

Typical Properties of #2000 Series

The typical properties of #2000 series (general ester type) are as follows.

Tested by Kuraray Co., Ltd.

Properties	Type	General Ester Type			Method	
	Grade	2185	2190	2195		
Density	g/cm ³	1.19	1.20	1.21	ISO1183	
Hardness (Shore A)	—	85	90	95	ISO7619	
100% Modulus	MPa	5	7	11	ISO37	
300% Modulus	MPa	11	24	23		
Tensile Strength	MPa	51	58	57		
Elongation	%	540	510	500		
Tear Strength	kN/m	88	118	181	ISO34	
Impact Resilience	%	59	54	46	Luepke	
Permanent Set	%	7	8	11	(*1)	
Compression Set (70 °C)	%	44	44	44	ISO815	
Taber Abrasion (H-22)	mg	15	20	30	ASTM D1044	
Tg	°C	-46	-38	-27	(*2)	
Vicat Softening Point (1 kg)	°C	92	105	122	ISO306	
Flow Temperature	°C	182	193	203	Flow tester (*3)	
Melt Viscosity	200 °C	kPa·s	1.0	—		1.8
	210 °C	kPa·s	—	0.5		0.8

< Measurement Conditions >

(*1) Permanent set

Tension: 300 %, Holding time: 60 sec, Temp.: 23 °C

(*2) Tg

Viscoelasticity measurement equipment (DVE-V4)

Tensile Mode, Heating Rate: 3 °C/min, Frequency: 0.1 Hz

(*3) Flow tester

(3-1)Flow temperature

Nozzle shape: 1 mm φ × 10 mmL, Load: 100 kgf, Temp. rise speed: 5 °C/min

(3-2)Melt viscosity

Nozzle shape: 1 mm φ × 10 mmL, Load:50 kgf

Typical Properties of #9000 Series

The typical properties of #9000 series (general ether type) are as follows.

Tested by Kuraray Co., Ltd.

Properties	Type	General Ether Type				Method	
	Grade	9180	9185	9190	9195		
Density	g/cm ³	1.12	1.13	1.13	1.15	ISO1183	
Hardness (Shore A)	—	80	85	90	95	ISO7619	
100% Modulus	MPa	4	5	7	11	ISO37	
300% Modulus	MPa	6	8	12	21		
Tensile Strength	MPa	33	46	48	52		
Elongation	%	640	610	560	500		
Tear Strength	kN/m	71	88	123	160	ISO34	
Impact Resilience	%	65	55	50	40	Luepke	
Permanent Set	%	8	10	13	17	(* 1)	
Compression Set (70 °C)	%	55	55	55	55	ISO815	
Taber Abrasion (H-22)	Mg	10	12	15	25	ASTM D1044	
Tg	°C	-52	-50	-42	-26	(* 2)	
Vicat Softening Point (1 kg)	°C	69	79	85	119	ISO306	
Flow Temperature	°C	165	175	184	194	Flow tester (* 3)	
Melt Viscosity	200 °C	kPa·s	1.2	1.4	1.6		—
	210 °C	kPa·s	—	—	—		1.0

< Measurement Conditions >

(* 1) Permanent set

Tension: 300 %, Holding time: 60 sec, Temp.: 23 °C

(* 2) Tg

Viscoelasticity measurement equipment (DVE-V4)

Tensile Mode, Heating Rate: 3 °C/min, Frequency: 0.1 Hz

(* 3) Flow tester

(3-1) Flow temperature

Nozzle shape: 1 mm ϕ × 10 mmL, Load: 100 kgf, Temp. rise speed: 5 °C/min

(3-2) Melt viscosity

Nozzle shape: 1 mm ϕ × 10 mmL, Load: 50 kgf

Typical properties of #3000 Series

The typical properties of #3000 series (special ester type) are as follows.

Tested by Kuraray Co., Ltd.

Properties	Type	Special Ester Type				Method
	Grade	3180	3185	3190	9195	
Density	g/cm ³	1.18	1.18	1.19	1.20	ISO1183
Hardness (Shore A)	—	80	85	90	95	ISO7619
100% Modulus	MPa	5	5	6	10	ISO37
300% Modulus	MPa	7	9	11	18	
Tensile Strength	MPa	42	52	57	57	
Elongation	%	660	630	560	520	
Tear Strength	kN/m	71	88	118	159	ISO34
Impact Resilience	%	50	45	40	35	Luepke
Permanent Set	%	8	9	11	14	(* 1)
Compression Set (70 °C)	%	45	45	45	55	ISO815
Taber Abrasion (H-22)	Mg	15	25	35	50	ASTM D1404
Tg	°C	-41	-38	-31	-19	(* 2)
Vicat Softening Point (1 kg)	°C	72	83	93	113	ISO306
Flow Temperature	°C	158	170	181	192	Flow tester (* 3)
Melt Viscosity	200 °C	kPa·s	1.0	1.2	1.5	
	210 °C	kPa·s	—	—	—	—

< Measurement Conditions >

(* 1) Permanent set

Tension: 300 %, Holding time: 60 sec, Temp.: 23 °C

(* 2) Tg

Viscoelasticity measurement equipment (DVE-V4)

Tensile Mode, Heating Rate: 3 °C/min, Frequency: 0.1 Hz

(* 3) Flow tester

(3-1) Flow temperature

Nozzle shape: 1 mm ϕ × 10 mmL, Load: 100 kgf, Temp. rise speed: 5 °C/min

(3-2) Melt viscosity

Nozzle shape: 1 mm ϕ × 10 mmL, Load: 50 kgf

Typical Properties of #8000 Series

The typical properties of #8000 series (special ester type) are as follows.

Tested by Kuraray Co., Ltd.

Properties	Type	Special Ester Type				Method
	Grade	8165	8170	8175	8180	
Density	g/cm ³	1.14	1.14	1.15	1.15	ISO1183
Hardness (Shore A)	—	65	70	75	80	ISO7619
100% Modulus	MPa	3	3	4	5	ISO37
300% Modulus	MPa	4	5	6	8	
Tensile Strength	MPa	29	35	42	50	
Elongation	%	890	780	700	650	
Tear Strength	kN/m	44	49	54	59	ISO34
Impact Resilience	%	69	66	62	58	(* 1)
Permanent Set	%	6	6	7	7	Luepke
Compression Set (70 °C)	%	37	34	32	32	ISO815
Taber Abrasion (H-22)	Mg	5	8	10	15	ASTM D1404
Tg	°C	-64	-61	-57	-55	(* 2)
Vicat Softening Point (1 kg)	°C	69	79	89	98	ISO306
Flow Temperature	°C	164	174	183	192	Flow tester (* 3)
Melt Viscosity	200 °C	kPa·s	1.1	1.3	1.5	
	210 °C	kPa·s	—	—	—	—

< Measurement Conditions >

(* 1) Permanent set

Tension: 300 %, Holding time: 60 sec, Temp.: 23 °C

(* 2) Tg

Viscoelasticity measurement equipment (DVE-V4)

Tensile Mode, Heating Rate: 3 °C/min, Frequency: 0.1 Hz

(* 3) Flow tester

(3-1) Flow temperature

Nozzle shape: 1 mm φ × 10 mmL, Load: 100 kgf, Temp. rise speed: 5 °C/min

(3-2) Melt viscosity

Nozzle shape: 1 mm φ × 10 mmL, Load: 50kgf

Typical Properties of #A Series

The typical properties of #A series (special ether type) are as follows.

Tested by Kuraray Co., Ltd.

Properties	Type	Special Ether Type		Method	
	Grade	A160S	A165S		
Density	g/cm ³	1.01	1.02	ISO1183	
Hardness (Shore A)	—	60	65	ISO7619	
100% Modulus	MPa	2	2	ISO37	
300% Modulus	MPa	3	3		
Tensile Strength	MPa	23	27		
Elongation	%	780	750		
Tear Strength	kN/m	—	—	ISO34	
Impact Resilience	%	68	68	Luepke	
Permanent Set	%	—	—	(* 1)	
Compression Set (70 °C)	%	51	50	ISO815	
Taber Abrasion (H-22)	Mg	10	5	ASTM D1404	
Tg	°C	—	—	(* 2)	
Vicat Softening Point (1 kg)	°C	60	66	ISO306	
Flow Temperature	°C	160	170	Flow tester (* 3)	
Melt Viscosity	200 °C	kPa·s	2.0		2.0
	210 °C	kPa·s	—		—

< Measurement Conditions >

(* 1) Permanent set

Tension: 300 %, Holding time: 60 sec, Temp.: 23 °C

(* 2) Tg

Viscoelasticity measurement equipment (DVE-V4)

Tensile Mode, Heating Rate: 3 °C/min, Frequency: 0.1 Hz

(* 3) Flow tester

(3-1) Flow temperature

Nozzle shape: 1 mm ϕ × 10 mmL, Load: 100 kgf, Temp. rise speed: 5 °C/min

(3-2) Melt viscosity

Nozzle shape: 1 mm ϕ × 10 mmL, Load: 50 kgf

Molding Conditions for Kuramiron™

The typical molding conditions for Kuramiron™ are shown below. However these conditions are the reference data. The actual molding conditions depend on the machine-type, the product shape and so on. Therefore please adjust molding conditions properly.

1 Extrusion conditions for #1000, #2000, #3000 and #9000 Series

Hardness (Shore A)	Temperature Condition (°C)				
	C1	C2	C3	Adapter	Die
80A	150 – 170	165 – 180	180 – 205	180 – 205	180 – 205
85A	155 – 175	170 – 185	190 – 210	190 – 210	190 – 210
90A	160 – 180	175 – 190	210 – 220	210 – 220	210 – 220
95A	165 – 185	180 – 195	215 – 230	215 – 230	215 – 230

2 Injection conditions for #1000, #2000, #3000 and #9000 Series

Hardness (Shore A)	Temperature Condition (°C)			
	C1	C2	C3	Nozzle
80A	145 – 160	165 – 180	180 – 200	180 – 205
85A	150 – 165	165 – 185	185 – 205	190 – 210
90A	155 – 170	170 – 190	190 – 210	210 – 220
95A	160 – 175	175 – 195	195 – 215	215 – 230

3 Extrusion conditions for #8000 and #A Series

Hardness (Shore A)	Temperature Condition (°C)				
	C1	C2	C3	Adapter	Die
60A	140 – 190	160 – 200	180 – 210	180 – 210	180 – 210
65A	140 – 195	160 – 205	180 – 215	180 – 215	180 – 215
70A	145 – 200	165 – 210	185 – 220	185 – 220	185 – 220
75A	150 – 205	170 – 210	190 – 220	190 – 220	190 – 220
80A	155 – 205	175 – 210	195 – 230	195 – 240	195 – 240

4 Injection conditions for #8000 and #A Series

Hardness (Shore A)	Temperature Condition (°C)			
	C1	C2	C3	Nozzle
60A	145 – 185	165 – 195	180 – 205	180 – 205
65A	145 – 190	165 – 200	180 – 210	180 – 210
70A	150 – 195	170 – 205	185 – 215	185 – 215
75A	155 – 200	175 – 210	190 – 220	190 – 220
80A	160 – 200	180 – 210	195 – 220	195 – 220

Other Considerations

1 Before Use

Before use, always read MSDS carefully.

2 Molding of Kuramiron™

At standard temperature conditions, the heat stability is good. Leaving at high temperatures for long periods of time, the possibility of pyrolysis exists.

3 Drying of Kuramiron™

Thermoplastic polyurethane elastomer is moisture sensitive. Kuramiron™ is packed in moisture-proof bags. However, it is recommended that the pellets be dried for 3-5 hours at 80 °C prior to use. A dehumidifying hopper dryer or circulation air oven may be used for drying.

4 Recycling

Kuramiron™ is a thermoplastic resin and as such, is recyclable and re-useable. Although it depends on the applications, generally the recycled material is blended with virgin resin for re-use. It is always important to confirm the properties of the recycled material before use.



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