NO. RRM03-015-E2

Introduction of KURARITY™ and polyester polymer compounds

KURARITY business promotion dept.
Elastomer Division

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Advantages of KURARITY™ and polyester polymer compounds

PMMA-*b*-PnBA-*b*-PMMA

KURARITY™ as “MAM” structure
-> Made by controlled living anionic polymerization

Features of “MAM”

- High polarity
- High Flow-ability

Advantages as compounds

- High flow formulation
- Adhesion to polar resin
- Good paint-ability
- Oil resistance (except Oleic acid)

KURARITY™ as a modifier of PBT

Overviewing of our new solution with KURARITY™ (Compare with conventional system)

	Flow-ability	Impact resistance
PBT /KURARITY™ compounds (New solution)	+	+
PBT high flow grades (Conventional solution)	+	-

Compare with conventional PBT high flow grades,

Our new solution is;

- ✓ (+-) Same levels or good flow ability
- ✓ (+) Excellent impact resistance

Overviewing of our new solution with KURARITY™ (Compare with conventional system)

		Ref.1	Ref.2	Ref.3	Ex.1	Ex.2	Ex.3
PBT	Standard grade, MFI = 21*	100		100	100	100	100
	High flow grade, MFI = 35*		100				
Modifier	KURARITY™ LA2250				5	10	
	KURARITY™ LA4285						5
	Acrylic impact modifier			5			

Items	Method	Units						
MFR (260 deg.C, 2.16 kgf)	ISO 1133	g / 10 min	42	58	30	38	40	39
Spiral flow (1 mmt)*	In-house method	mm	170	190	160	190	250	180
Charpy impact with notch	ISO 179	kJ / m^2	3.5	3.3	6.4	5.7	5.8	5.8
Flexural modulus	ISO 178	GPa	2.2	2.3	2.1	2.1	1.9	2.1

*250 deg.C, 2.16 kgf
**MEIKI M100C, Injection temp.: 260 deg.C, Mold temp.: 80 deg.C, Injection pressure: 100 MPa, Injection rate: 50 mm / sec

- ✓ Ex.1 and Ex.2 show same levels or higher flow ability than PBT high flow grade as Ref.2.
- ✓ Ex.1 to Ex.3 show higher impact resistance than Ref.1 and Ref.2.

KURARITY™ / polyester soft compounds

Overviewing of our new solution with KURARITY™ (Compare with conventional system)

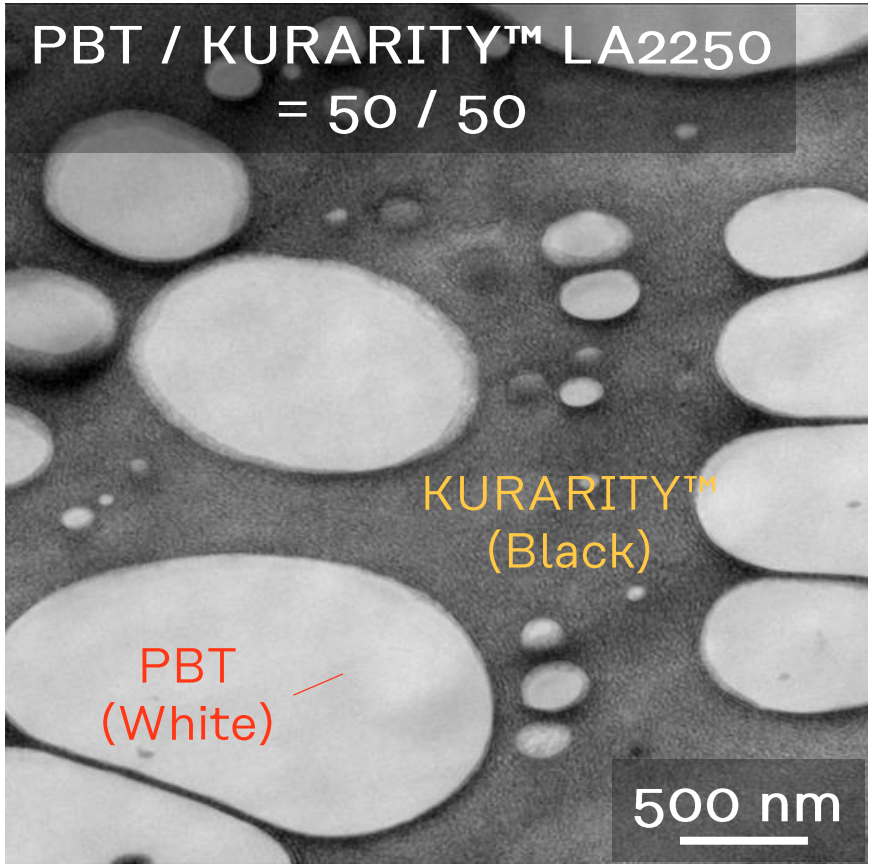
	Flow-ability	Adhesion to polar resin	Paint-ability	Oil resistance (except Oleic acid)
Crystalline Polyester / KURARITY™ compounds (New solution 1)	++	+-	++	++
Amorphous Polyester / KURARITY™ compounds (New solution 2)	++	+	++	+
TPC or TPC / TPS compounds (Conventional)	+-	++	+-	+-

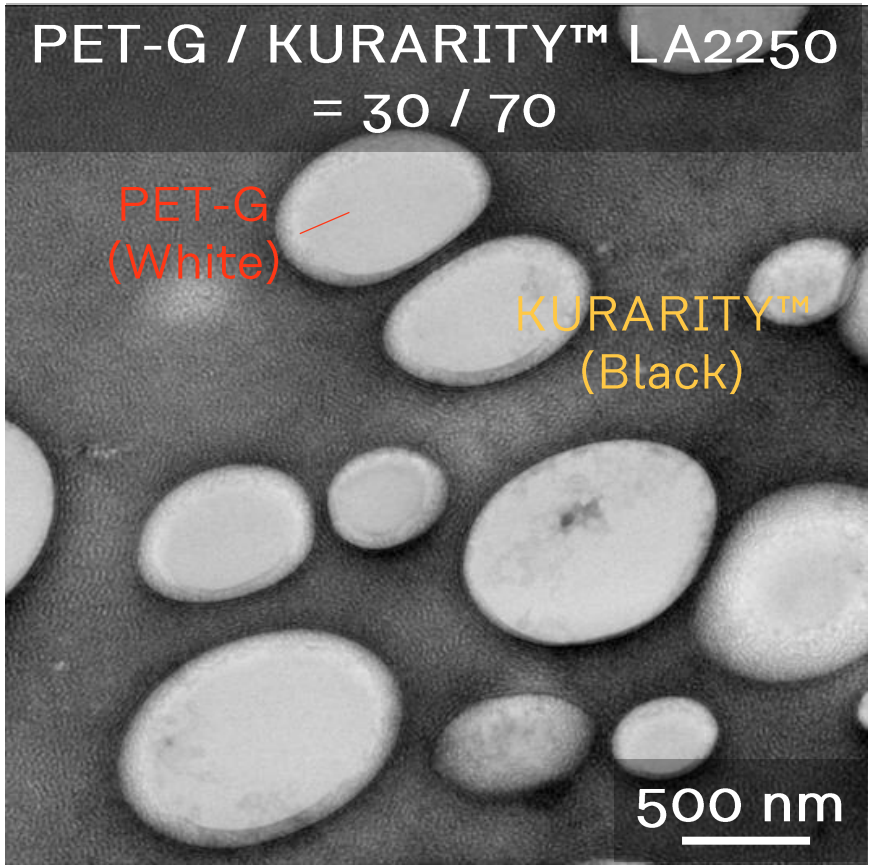
Compared with conventional TPC (Thermo-Plastic Co-polyester elastomer)

or TPC / TPS (Thermo-Plastic poly-Styrene elastomer) compounds, Our new solution is;

- ✓ (-) Moderate or low adhesion force to polar resin
- ✓ (+) Excellent flow-ability, paint-ability and Oil resistance

TEM image





✓ Amorphous Polyester / KURARITY™ formulation shows better dispersion compared with Crystalline Polyester / KURARITY™ formulation.

Typical properties

			Ex.1	Ex.2	Ex.3	Ex.4	Ex.5
PBT (Standard grade, MFI = 21*)			50				
PET-G (Injection molding grade)				30	30		
KURARITY™ LA2250			50	70	50		
KURARITY™ LA4285					20		
TPC						100	
TPC / TPS compound							100
Items	**Method**	**Units**					
ISO type A (after 15 sec)	ISO 7619-1	-	80	65	79	77	77
MFR (230 deg.C, 2.16 kgf)	ISO 1133	g / 10 min	70	190	90	31	12
Flammability (UL-94)	ASTM D635	-	HB	HB equivalent	HB equivalent	HB	HB equivalent

*250 deg.C, 2.16 kgf

- ✓ KURARITY™ shows good compatibility with PBT and PET-G without any compatibilizer.
- ✓ Ex.1 to EX.3 show higher flow-ability than TPC and TPC based compound.

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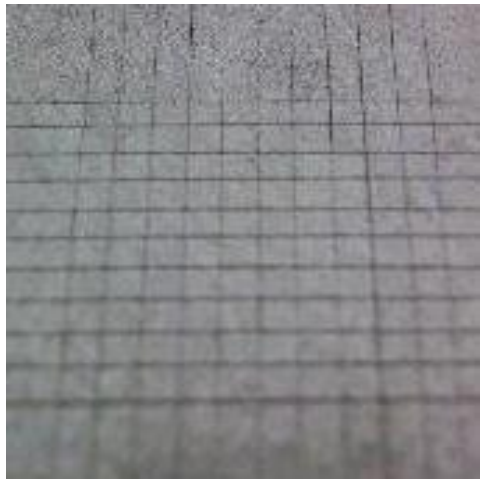
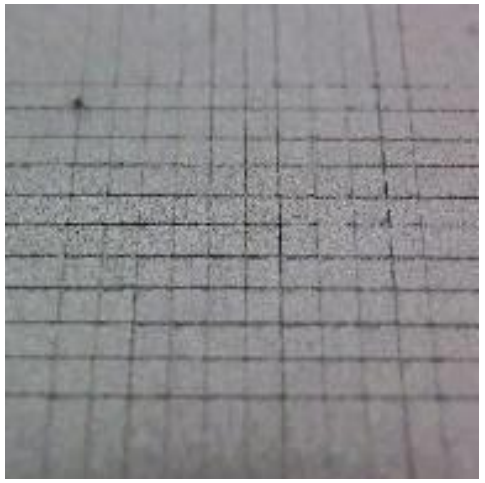
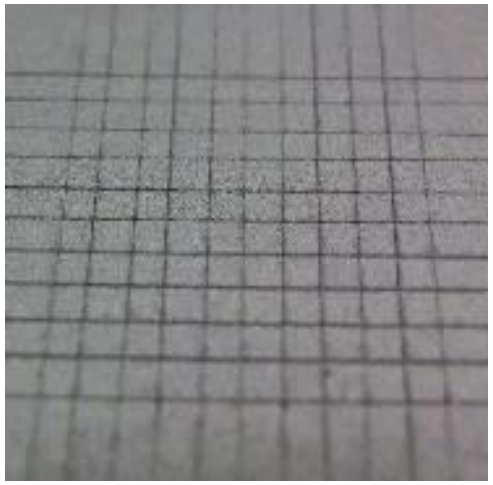
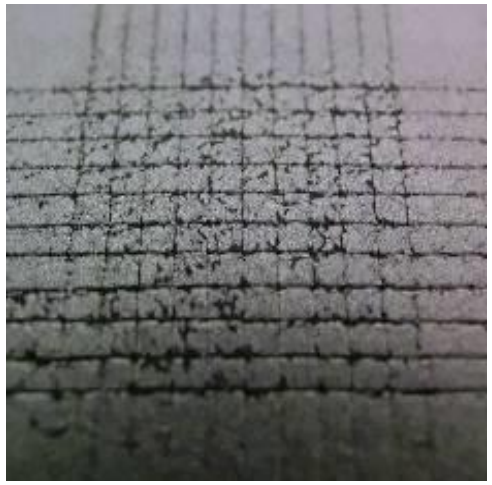
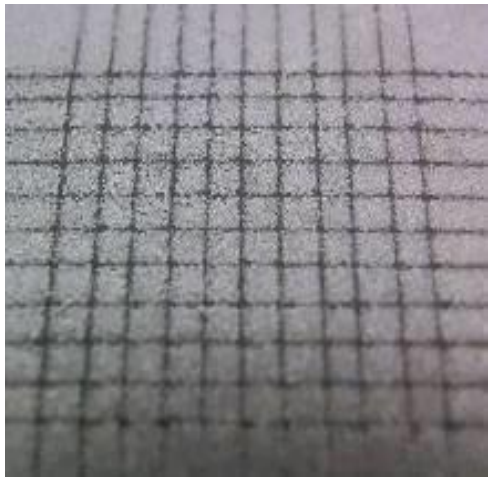
Typical properties

				Ex.1	Ex.2	Ex.3	Ex.4	Ex.5
PBT (Standard grade, MFI = 21*)				50				
PET-G (Injection molding grade)					30	30		
KURARITY™ LA2250				50	70	50		
KURARITY™ LA4285						20		
TPC							100	
TPC / TPS compound								100
Item	**Units**		**Molding temp.**					
Adhesion to polar resin	N / 25 mm	to ABS	230 deg.C	6.5	>60	>54	68	29
			250 deg.C	23	>92	>77	No data	No data
		to PC	230 deg.C	5.3	>68	19	>200	>140
			250 deg.C	20	>87	>100	No data	No data

*250 deg.C, 2.16 kgf

- ✓ Ex.2 and Ex.3 show moderate adhesion to polar resin compared with Ex.4 and Ex.5.
- ✓ Ex.1 should be molded higher temperature.

Paint-ability

Ex.1	Ex.2	Ex.3	Ex.4	Ex.5
PBT / KURARITY™	PET-G / KURARITY™	PET-G / KURARITY™	TPC	TPC / TPS compound
				
Classification: 0 (Completely smooth)	Classification: 0 (Completely smooth)	Classification: 0 (Completely smooth)	Classification: 2 (Flaked under 15%)	Classification: 1 (Flaked under 5%)

✓ **Polyester / KURARITY™ compounds show better paint-ability**

Test Piece: 60 mm W x 60 mm D x 2 mm T Injection Molded,
Coating Material: Planet PX-1 Silver / Polyhard MH / Thinner #210=4 / 1 / 2, Origin Electric Co. Ltd. product
Drying Condition: 70 deg.C x 60 min
Adhesion test (Cross-cut test): Number of cuts = 10 x 10 (1 mm) (Kuraray method)
Classification: 0 (excellent adhesion) - 5 (poor adhesion) (ISO 2409)

Chemical resistance

				Ref.4	Ref.5	Ex.4	Ex.5	Ex.6
PBT (Standard grade, MFI = 21*)						50		
PET-G (Injection molding grade)							30	30
KURARITY™ LA2250						50	70	50
KURARITY™ LA4285								20
TPC				100				
TPC / TPS compound					100			
Items	Methods	Conditions	Units					
Lubricating Oil	In-house method (Immersed)	65 deg.C, 24 hr	Δwt %	8.5	38	2.4	4.3	3.4
Castor Oil		23 deg.C, 168 hr		20	7.1	2.6	4.0	5.1
Hand Cream		23 deg.C, 168 hr		7.9	25	2.8	4.5	4.6
50 wt% Ethanol aq.		23 deg.C, 168 hr		6.8	4.9	4.7	5.9	5.6
Oleic acid		60 deg.C, 96 hr		110	120	120	200	140

* 250 deg.C, 2.16 kgf

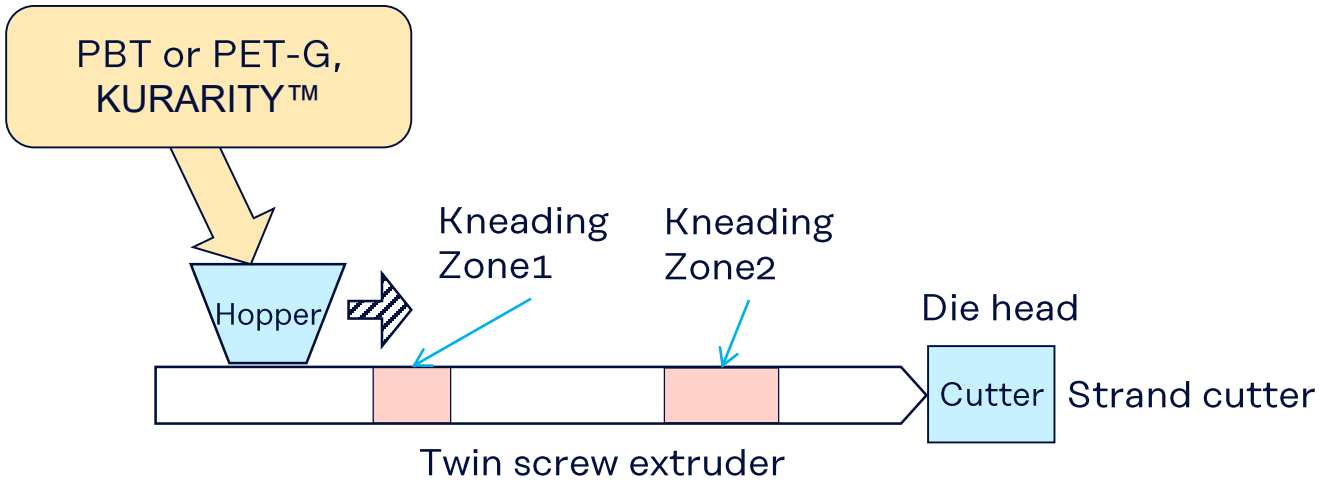
- ✓ Polyester/ KURARITY™ compounds show better chemical resistance compared with TPC and TPC / TPS compound except for Oleic acid.

Test compounding conditions

Equipment example

Twin extruder: ZSK 25 (Coperion)

Screw: 25mmf, L/D=54



Temperature [deg.C]	C2 (hopper)	C3～C11	C12	Die head
	50	220-240	210-230	210-230
Screw rotation [rpm]	200-300			
Vent	Pull			
PCW temperature [deg.C]	30-50			

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