NO. RRF03-001-E1

SEPTON™ BIO-series as impact modifier of PLA for extrusion molding

Elastomer R&D department
Elastomer division

kuraray Septon™ BIO-series

Excellent impact modifier for PLA

SEPTON™ BIO-series shows excellent impact modification compared to general HSBCs.

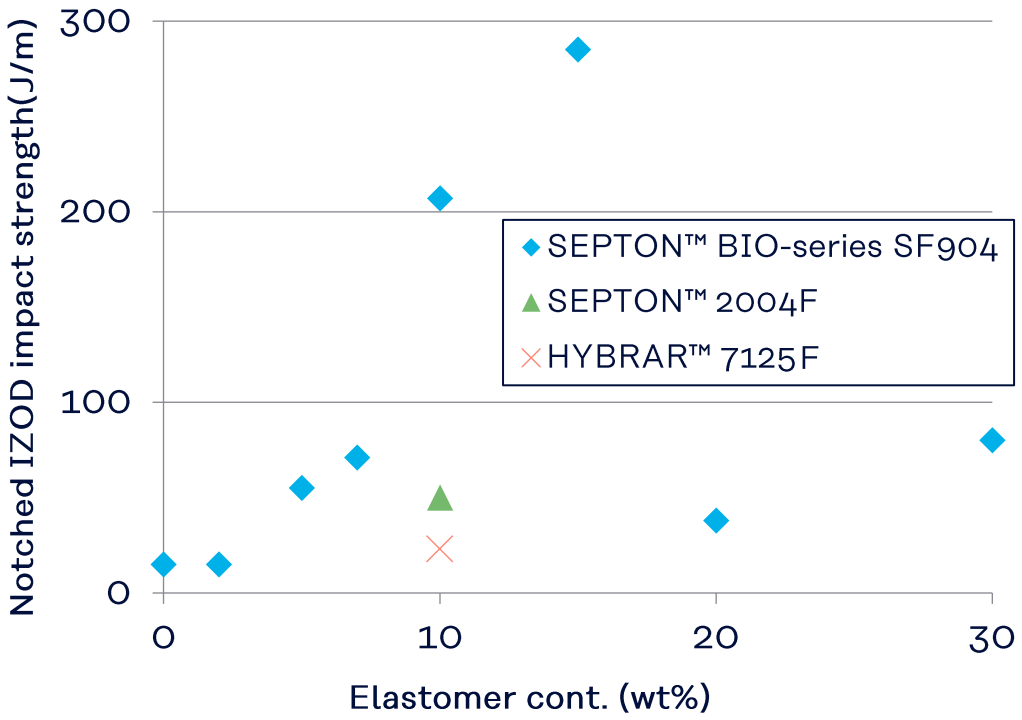
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PLA (Ingeo™ 2003D)	NatureWorks LLC		100	97	95	93	90	85	80	70	90	90
SEPTON™ BIO-Series SF904 (St=21 wt%)	Kuraray Co., Ltd.		0	2	5	7	10	15	20	30		
SEPTON™ 2004F (St=18 wt%)	Kuraray Co., Ltd.										10	
HYBRAR™ 7125F (St=20 wt%)	Kuraray Co., Ltd.											10
Carbodilite LA-1 [1)]	Nisshinbo Chemical Inc.	phr	1	1	1	1	1	1	1	1	1	1
ADKSTAB AO-60 [2)]	ADEKA Corporation		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Properties:												
MFR (210 deg. C, 2.16 kg)		g/10 min	3.6	3.6	3.7	3.9	3.9	4.4	4.8	6.4	4.7	4.3
Notched izod impact strength		J/m	15	15	55	71	207	285	38	80	23	23
Flexural strength		MPa	78	71	63	60	57	46	33	5	53	55
Flexural modulus		MPa	2360	2240	2040	1950	1870	1580	1240	140	1770	1820

1) Hydrolysis stabilizer
2) Antioxidant

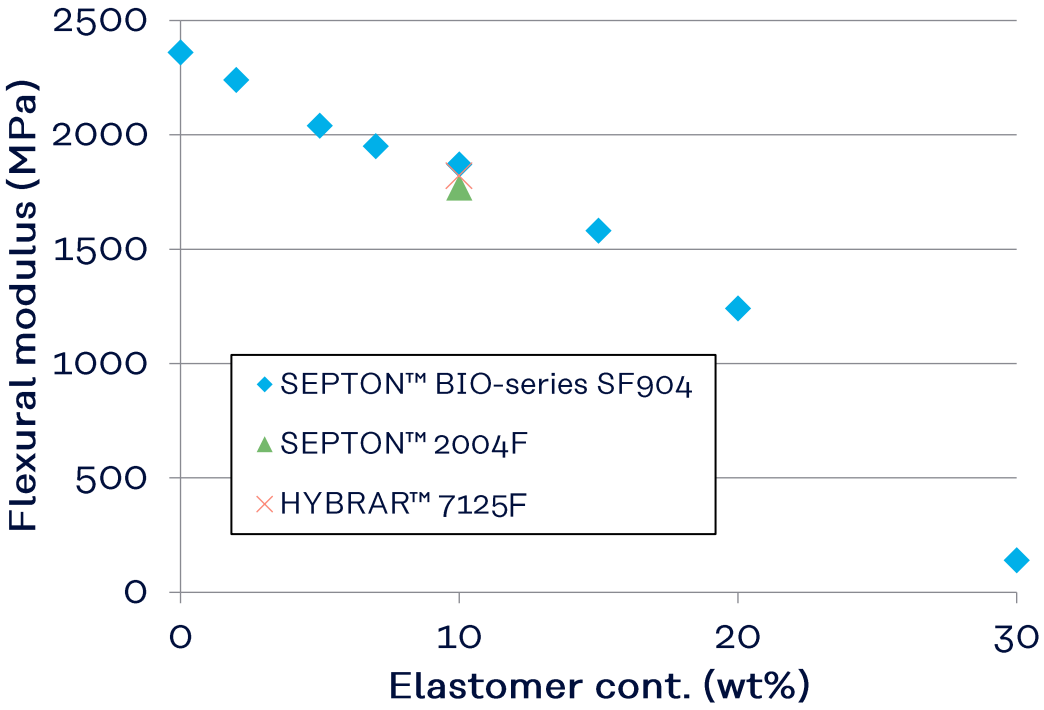
Mixing conditions
200 deg. C, 3 min.

Compression molding conditions
200 deg. C, preheating 2 min, 10 MPa x 3 min.

Excellent impact modifier for PLA



Noched izod impact strength



Flexural modulus

Potential applications

	Strength	Potential applications
PLA Modifier	High impact strength, Good low-temperature characteristics, High bio-cont.	3D printing filament, Trays, Housings of home electric appliances

NO. RRF03-002-E1

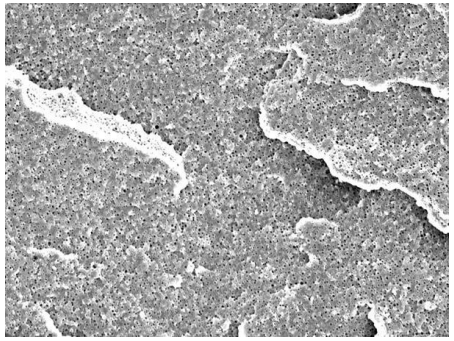
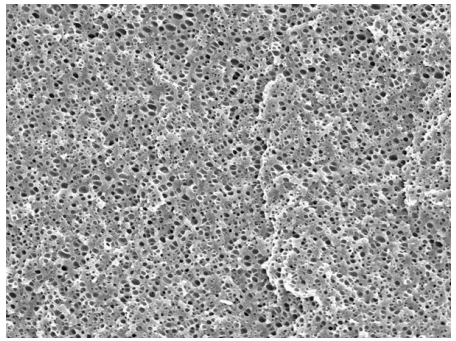
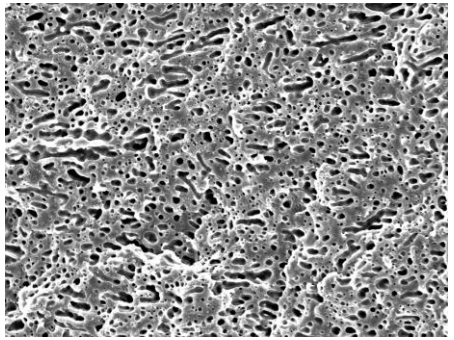
SEPTON™ BIO-series as impact modifier of PLA for Injection molding

Elastomer R&D department
Elastomer division

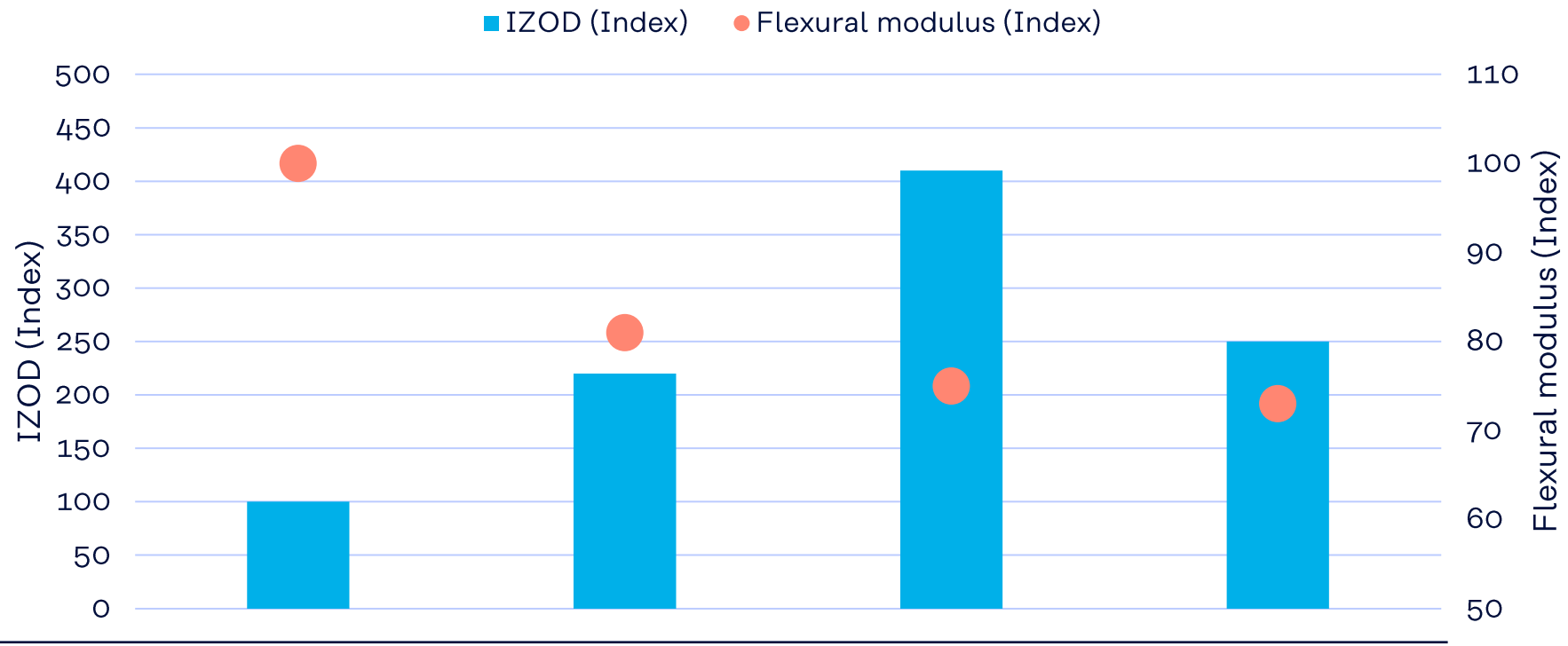
kuraray Septon™ BIO-series

Excellent impact modifier for PLA (Injection molding)

SEPTON™ BIO-series shows excellent impact modification compared to general HSBCs.

		PLA (Ingeo™ 3001D)	PLA/ SEPTON™ BIO-series SF904 (90/10)	PLA/ SEPTON™ BIO-series SF904 (85/15)	PLA/ SEPTON™ 2004F (90/10)
SEM					
Particle size (Ave.)	μm		0.52	0.94	1.41
IZOD	kJ/m²	2.3	5.0	9.5	5.7
Flexural modulus	MPa	3,400	2,800	2,600	2,500
Bio-based content	wt%	100	95	92.5	90

Excellent impact modifier for PLA (Injection molding)



	PLA (Ingeo™ 3001D)	PLA/ SEPTON™ BIO-series SF904 (90/10)	PLA/ SEPTON™ BIO-series SF904 (85/15)	PLA/ SEPTON™ 2004F (90/10)
IZOD (Index)	100	220	410	250
Flexural modulus (Index)	100	81	75	73

Mixing & Molding condition

Material

		Styrene content (wt%)	Bio-based content (wt%)	Manufacturer
SEPTON™ BIO-series SF904	HSFC	21	50	Kuraray Co., Ltd.
SEPTON™ 2004F	HSBC	18	0	Kuraray Co., Ltd.
Ingeo™ 3001D	PLA (Injection grade)	-	100	Nature works LCC

Mixing condition

Extruder (Twin screw)	ZSK26Mc (Coperion GmbH)
L/D	56 (D = Φ25.5)
Temperature	180 deg. C
Out put	20 kg/h

Injection condition

Injection machine	EC75SX (Shibaura Machine Co., Ltd.)
Cylinder temperature	230 deg. C
Mold temperature	60 deg. C

Measurement method

Particle size (SEM)

MACHINE	JSM-6510 (JEOL Ltd.)
Observation area	Notched impact fracture surface
Extraction solvent	Cyclohexane
Etching time	5 min
Magnification	x 1,000

Izod (Notched)

	JIS K 7110
Test piece	80 mm x 4.0 mm x 10 mm

Flexural modulus

	JIS K 7171
Test piece	80 mm x 4.0 mm x 10 mm
Cross-head speed	2 mm/min

Potential applications

	Strength	Potential applications
PLA Modifier	Small reduction in flexural modulus High impact strength Good low-temperature characteristics High bio-cont.	Trays Housings of home electric appliances

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