www.aspact.co.kr

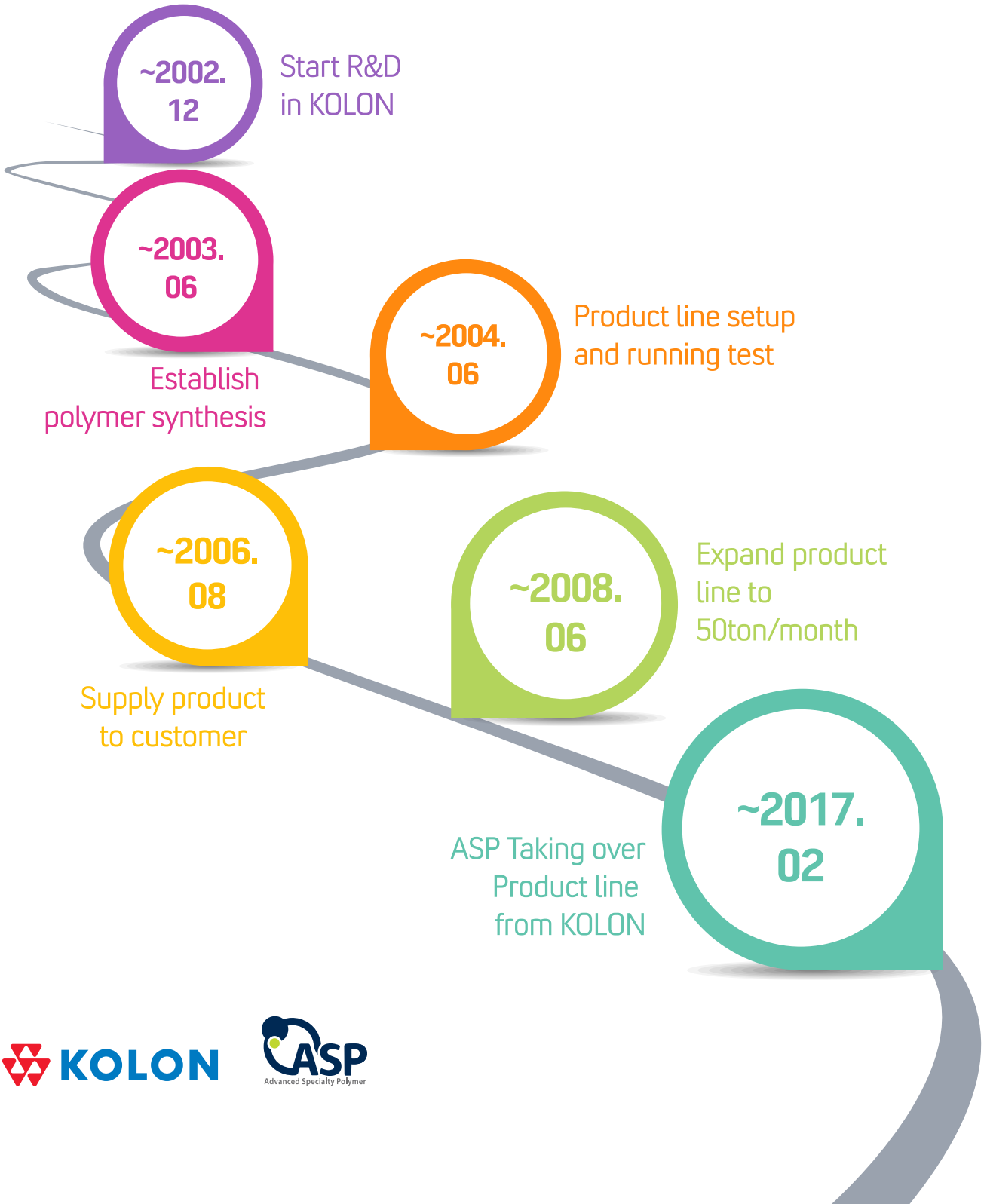
Diasphere®

is Organic Polymer Bead of ASP

Diffusion Agents of diffusion film and plate
Matting/Texture Agent of paint, Ink and plastic
Anti-blocking Agents of Packaging PP film and Leather surface
Anti-Glare Agents of functional film
Pore forming agents of ceramic material
Filler of Cosmetics and Toiletries

ASP
Advanced Specialty Polymer

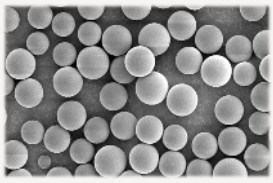
Advanced Specialty Polymer Ltd. for **Diasphere®**



KOLON ASP Advanced Specialty Polymer

Diasphere® is the brand name of ASP Co., Ltd

- Spherical polymeric beads having 0.2 ~ 100㎛ average particle size by very unique polymerization technique.
- Functional organic polymeric bead based on acrylic monomer and its co-monomer, styrene monomer and silane derivatives.
- Application : Light diffusing agent for light diffusing film and plate, texture and anti-slip agent for paint and coatings, filler for cosmetics and toiletries, delustering/texture and anti-blocking agent for plastics and film, pore forming agent for ceramic material and so on.



Display

Lighting Plate

Home appliance

Packaging film

Car DPF/GPF

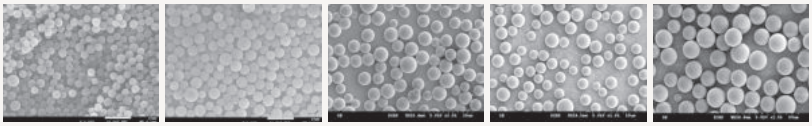
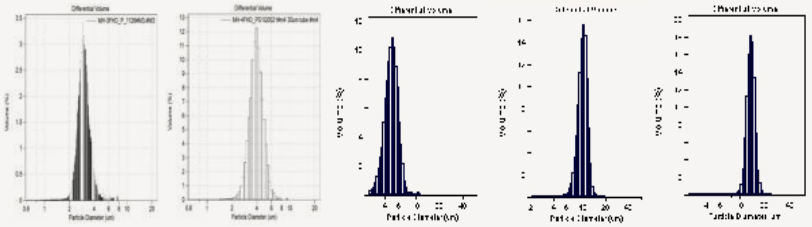
Cosmetics

Diasphere® Line-up

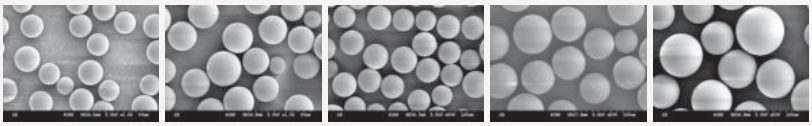
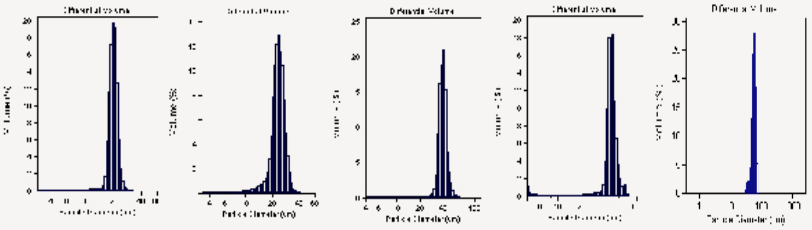
Material	Grade	Ave. Particle Size(um)	Refractive Index	Thermal Property[1]	Hardness[2]
Acrylic Polymer (PBMA)	BH-5	5	1.48	240℃~260℃	10
	BH-10	10			
Acrylic Polymer (PMMA)	MH-3FHD	3	1.49	315℃	27
	MH-4FHD	4		320℃	
	MH-5FHD	5		322℃	
	MH-5FD	5		240℃~260℃	
	MH-10FD	10			
	MH-15FD	14			
	MH-20FD	20			
	MH-25FD	24			
	MH-30FD	30			
	MH-40FD	40			
	MH-50FD	50			
	MH-60FD	60			
	MH-70FD	70			
	MH-80FD	80			
	MH-100FD	100			
Styrene Polymer (PS)	MS-3FHC	3	1.59	310℃	25
	MS-5FHC	5			
	MS-10FHC	10			
Core/shell type Styrene Polymer in water base (PS)	SNX-200H	0.2	1.49	295℃	25
	SNX-400H	0.4			
	SNX-600H	0.6			
Silicone (PMSQ)	KS-200	2	1.42	Over 400℃	15
	KS-500	5			
	KS-1000	10			

1) 3% Weight Loss by TGA
2) 10% Compression Strength, Mpa by MCTM

Diasphere® Line-up

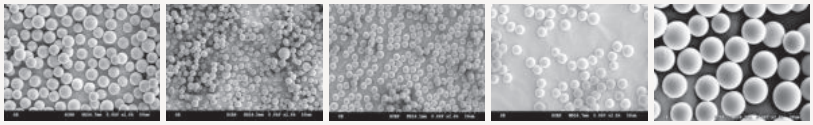
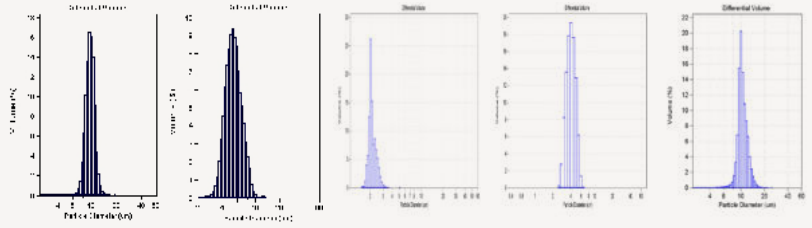
	PMMA				
	MH-3FHD	MH-4FHD	MH-5FHD/5FD	MH-10FD	MH-15FD
SIZE(㎛)	3	4	5	10	13
SEM Image					
PSD					

•SEM Image : MH-3FHD, 4FHD, 5FHD x 2.0k and 10FD, 15FD x 1.0k
•PSD(Particle Size Distribution) : Coulter Multisizer 4

	PMMA				
	MH-20FD	MH-25FD	MH-40FD	MH-60FD	MH-80FD
SIZE(㎛)	20	25	40	60	80
SEM Image					
PSD					

•SEM Image : MH-20FD, 25FDx1.0k and MH-40FD, 60FD, 80FDx500
•PSD(Particle Size Distribution) : Coulter Multisizer 4, LS 13 320

Diasphere® Line-up

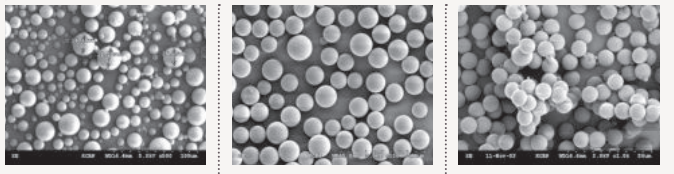
	Styrene	PBMA	Silicone		
	MS-10FHC	BH-5	KS-200C	KS-500	KS-1000
SIZE(㎛)	10	5	2	5	9
SEM Image					
PSD					

•SEM Image : MS-10FDC, BH-5 x 1.0k and Silicone x 2.0k
•PSD(Particle Size Distribution) : Coulter Multisizer 4

Key Characteristic of Diasphere®

1) Narrow size distribution

Distribution of several types of Polymer bead



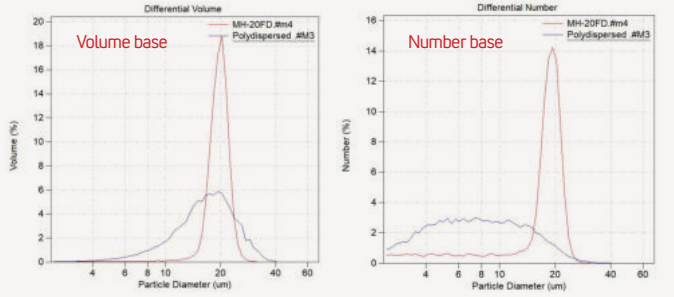
Competitors
Over C.V. 30%
Polydispersed

ASP Diasphere®
C.V. 10-12%
Medium size distribution

Competitors
C.V. 10%
Monodispersed

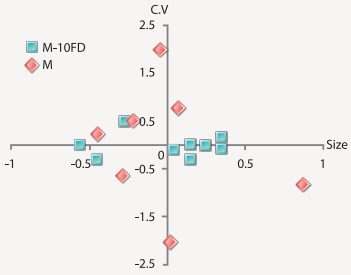
C.V. 30% C.V. 20% C.V. 10% C.V. 5%

Same method as polydispersed bead, but provide close to monodispersed product



Provide very narrower size distribution than polydisperse one and see the big difference in volume mode and even more in number mode.

Key Characteristic of Diasphere®



• Each of square and diamond values mean the variance from mean value.

2) Quality Reliability

• Lower Deviation of Avg. and C.V., Higher Quality Reliability
• Support customer to give higher quality solution

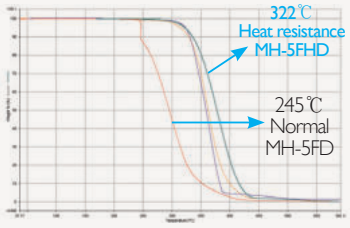
C.V. and Mean size data of MH-10FD and competitor

C.V.(%)	1	2	3	4	5	6	7	8	9	AVG.	Standard Deviation
MH-10FD	15.0	14.8	14.8	15.1	15.0	15.1	15.2	15.6	15.1	15.08	0.24
"M"	38.9	39.2	37.8	38.6	37.6	36.4	40.4			38.41	1.29
Size(㎛)	1	2	3	4	5	6	7	8	9		
MH-10FD	10.0	9.8	9.2	9.1	9.7	9.9	10.0	9.4	9.4	9.66	0.34
"M"	11.9	12.2	11.8	11.6	12.9	12.1	12.1			12.09	0.42

• "M" : Competitor "S" 10um polydispersed PMMA

3) Higher Heat Resistance Organic Polymer Bead

Decomposition Temperature(97%)



• TGA Test

• Higher decomposition temperature than normal organic bead.
• Not yellowed in process because of less weight loss.
• Recommended where resins are kneaded wiht high temperature.
• At 280℃ oven test, Heat resistance bead show concrete thermal properties.

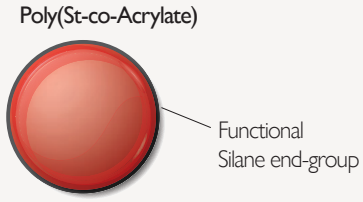
300℃ Oven Test	10min	30min	Color Change	Drying Loss
Heat Resistance			No	1.5%
Normal			Yellow	62.2%

• 10% Bead in M/B with PC matrix and 5% M/B is loaded in PC sheet.

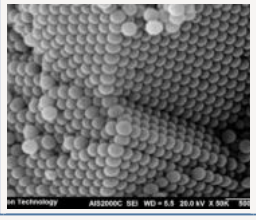
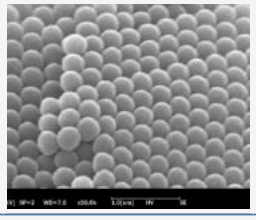
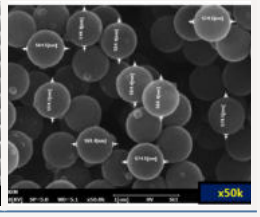
	L*	a*	b*	YI
Heat 5FD MB	76.96	-0.85	0.97	
Normal 5FD MB	75.31	-0.83	1.33	
Heat 5FD PC Sheet	78.81	-0.187	1.407	2.43
Normal 5FD PC Sheet	77.88	-0.302	1.913	3.37

Characteristic of Diasphere® for New Application

New Products



Highly crosslinked Polystyrene core/shell structured nano size particle

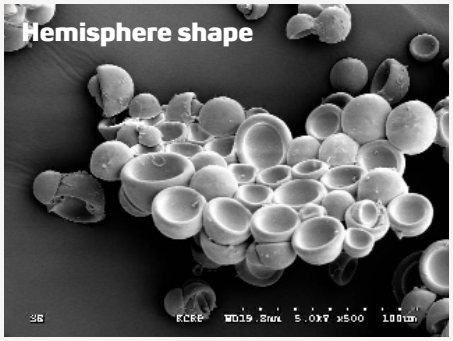
Name	SNX-200H	SNX-400H	SNX-600H
Particle size(nm)	200	400	600
SEM Image (15K)			

- Particle size is measured by Malvern Zetasizer

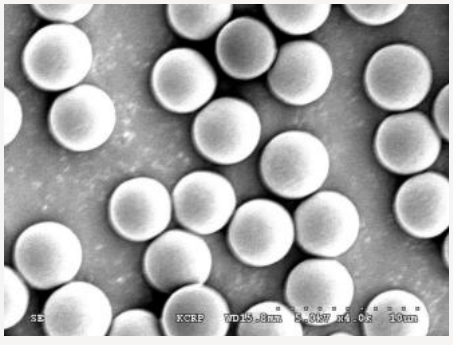
Key Characteristic of Diasphere®

New Products

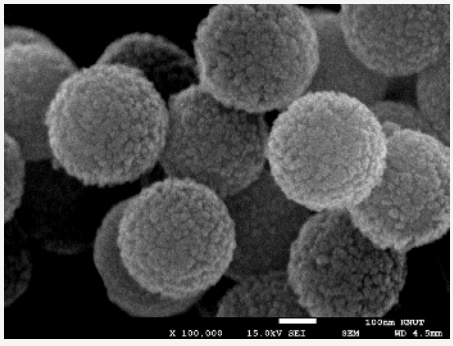
Shape controlled bead



Monodispersed PMMA



Special surface treatment bead with several types of material like metal and inorganic by customer's requirements



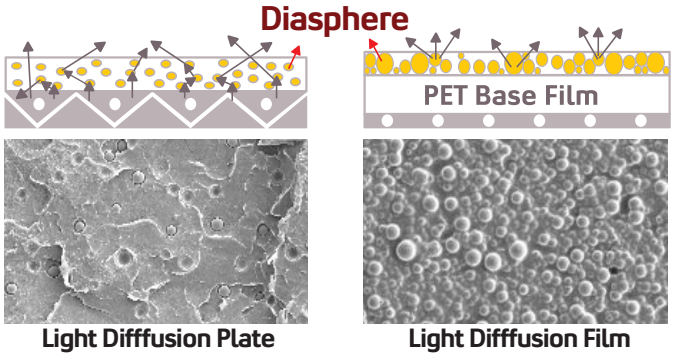
Display

Diffusion Film
Diffusion Plate for LCD Backlight Module

Characteristic of Diasphere® for Display

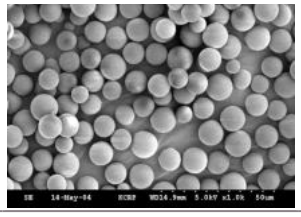
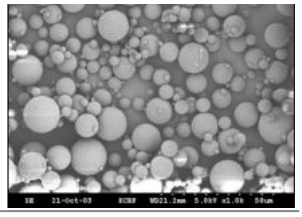
LCD Light diffusion film and plate

- Narrow Particle Size Distribution Gives High Luminance
- Excellent diffusion effect with higher transmittance
- Almost Parallel Light [Important for LCD Backlight Unit]
- Easy Dispersion in Solvents and Waterborne and Excellent Solvent & Weather Resistance



Light Difffusion Plate　　Light Difffusion Film

Feature of MH-Series

	ASP Diasphere® MH-10FD	Competitor "S"
Average Particle Size	10㎛	10㎛
Distribution(C.V.%)	13.5%	40.2%
Thermal stability (wt% Loss at 300 ℃)	1.05%	1.40%
Water Contents	0.4%	0.8%
Residual Monomer	0ppm	0ppm
Distinction	Narrow size distribution Excellent diffusion effect	Broad size distribution
SEM Image		

• C.V.% : (Standard Deviation/ Average particle size) x 100

Luminance of Diffusion Film

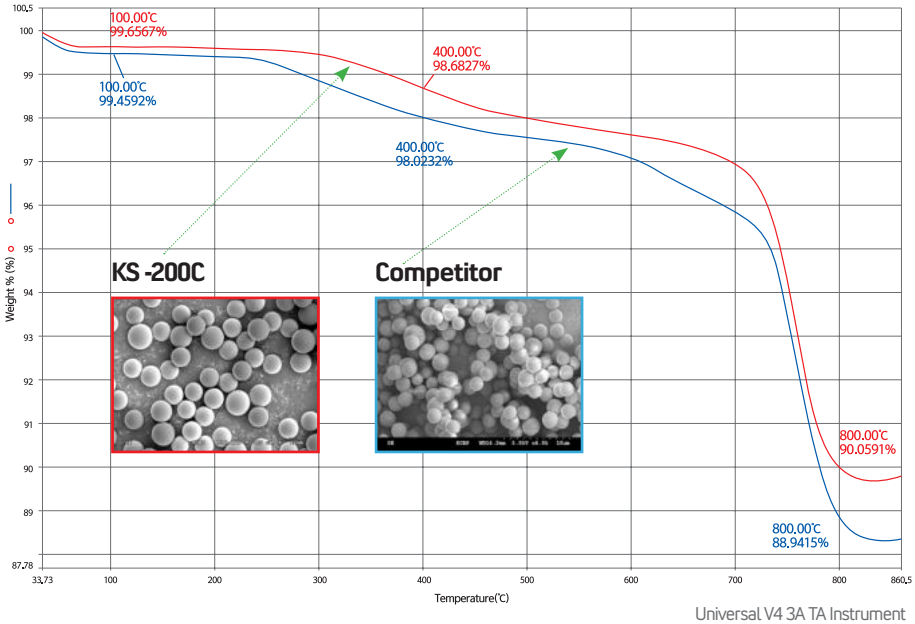
• Show almost same luminance compared with monodispersed PMMA

	Luminance (cd/㎡)							
	1 sheet	(%)	2 sheet	(%)	3 sheet	(%)	1 sheet + BEF	(%)
ASP MH-10FD	1619	0	1889	0	1962	0	2656	0
Competitor "S" Polydispersed	1440	-11.0	1615	-14.5	1738	-11.4	2567	-3.4
Competitor "S" monodispersed	1618	-0.1	1886	-0.2	1954	-0.4	2658	+0.1

Characteristic of Diasphere® for Display

Features of KS-Series(Silicone Bead)

- KS-200C has more excellent heat stability than competitor
- Suitable for high temperature process system such as polycarbonate



Universal V4 3A TA Instrument
N2 condition, 10℃ increase @1min

Luminance of Diffusion Plate

Total Loading (%)	KS-200C	Competitor	KS-200C	Competitor	KS-200C	Competitor
	0.3		0.5		0.7	
Haze	98.05	98.03	98.17	98.09	98.65	98.66
TT	83.88	84.04	76.48	75.32	70.74	71.46
DF	82.25	82.39	75.08	73.88	69.79	70.5
PT	1.64	1.66	1.4	1.44	0.95	0.96
Luminance	4591.5	4563.5	4617.9	4631	4528.8	4534.8
△Luminance	0.61%	-	-0.28%	-	-0.13%	-
Coordinate x	0.2437	0.2440	0.2448	0.2450	0.2448	0.2448
(△x)	-0.0003	-	-0.0002	-	0.0000	-
Coordinate y	0.2264	0.2259	0.2283	0.2287	0.2288	0.2285
(△y)	0.0005	-	-0.0004	-	0.0003	-

- Dispersed silicone bead in PS matrix resin.
- One layer plate with 1.5T thickness using Single Extruder.
- Measure Luminance using BM7 and Optical properties using NDH2000.

Lighting Plate

LED Lighting Cover
Conventional Sign Board Cover

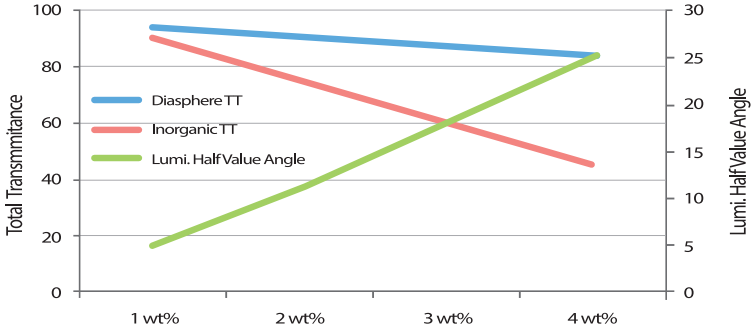
Characteristic of Diasphere® for Lighting Plate

Functions

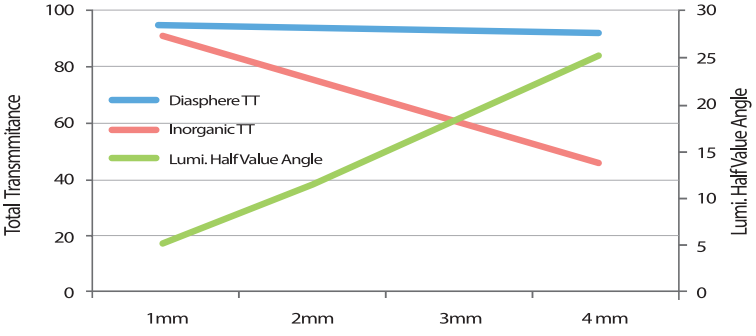
- Excellent diffusion effect with higher transmittance : over 85 % transmittance and haze can be obtained at the same time
- Much higher output ratio of incident light compared to inorganics
- Much lower impact strength depression compared to inorganics : cost and energy saving, flexibility for choosing matrix resin

Applications

- Light diffusing agent for diffusing plate of LCD and lighting cover of LED
- Optical properties on concentration



- Optical properties on thickness



- Optical Properties of PC Diffusing Plate with MH-10FD and TiO_2

Sample	Optical Properties			
	Haze	TT	DF	PT
MH-10FD 0.5%	64.26	87.95	56.52	31.43
MH-10FD 1.0%	85.75	85.59	73.39	12.20
TiO_2 0.02%	18.50	91.40	15.60	75.80
TiO_2 0.5%	84.20	60.60	51.10	9.50

- TT : Total Transmittance(PT+DF), DF : Diffusion, PT : Parallel Transmittance
- Haze = DF/TT×100
- 2 mm Sheet

Characteristic of Diasphere® for Lighting Plate

Optical Properties of Diffusing Plate with KS-200C in PC Matrix

KS-200C, PC Matrix

0.5%	Hz	TT	DF	PT
1.0 T	98.77	74.82	73.90	0.92
1.5 T	99.48	65.21	64.87	0.34
2.0 T	99.59	58.93	58.69	0.24
2.5 T	99.65	53.57	53.38	0.19
3.0 T	99.68	49.59	49.43	0.16

1.0%	Hz	TT	DF	PT
1.0 T	99.63	63.65	63.41	0.24
1.5 T	99.70	56.72	56.55	0.17
2.0 T	99.73	52.09	51.95	0.14
2.5 T	99.73	48.37	48.24	0.13
3.0 T	99.71	45.33	45.20	0.13

1.5%	Hz	TT	DF	PT
1.0 T	99.71	57.79	57.62	0.17
1.5 T	99.73	52.68	52.54	0.14
2.0 T	99.73	48.67	48.54	0.13
2.5 T	99.73	44.99	44.87	0.12
3.0 T	99.71	41.72	41.60	0.12

2.0%	Hz	TT	DF	PT
1.0 T	99.73	54.76	54.61	0.15
1.5 T	99.74	49.32	49.19	0.13
2.0 T	99.73	44.92	44.80	0.12
2.5 T	99.75	40.25	40.15	0.10
3.0 T	99.73	37.34	37.24	0.10

• Measure optical properties using NDH5000 ISO mode

Optical Properties of Diffusing Plate with MH-5FHD in PC Matrix

MH-5FHD, PC Matrix

0.5%	Hz	TT	DF	PT
1.0 T	95.50	87.02	83.10	0.92
1.5 T	97.56	84.68	82.61	2.07
2.0 T	98.76	78.74	77.76	0.98
2.5 T	99.15	73.78	73.15	0.63
3.0 T	98.97	76.63	75.84	0.79

1.0%	Hz	TT	DF	PT
1.0 T	97.20	87.94	85.48	2.46
1.5 T	98.60	83.82	82.65	0.17
2.0 T	99.08	78.92	78.19	0.73
2.5 T	99.31	73.54	73.03	0.51
3.0 T	99.41	68.24	67.84	0.40

1.5%	Hz	TT	DF	PT
1.0 T	98.72	84.13	83.05	1.08
1.5 T	99.29	76.19	75.65	0.54
2.0 T	99.45	69.59	69.21	0.38
2.5 T	99.56	63.49	63.21	0.28
3.0 T	99.60	58.05	57.82	0.23

2.0%	Hz	TT	DF	PT
1.0 T	99.27	78.23	77.66	0.57
1.5 T	99.54	68.88	68.56	0.32
2.0 T	99.61	62.10	61.86	0.24
2.5 T	99.66	55.48	55.29	0.19
3.0 T	99.67	51.79	51.62	0.17

• Measure optical properties using NDH5000 ISO mode

Characteristic of Diasphere® for Lighting Plate

Optical Properties of Diffusing Plate with the mixture of KS-200C and MH-5FHD in PC Matrix

KS200C 0.5%+5FHD 0.25%

0.5%	Hz	TT	DF	PT
1.0 T	98.45	77.96	76.75	1.21
1.5 T	99.28	69.89	69.39	0.50
2.0 T	99.52	62.71	62.41	0.30
2.5 T	99.60	57.31	57.08	0.23
3.0 T	99.64	52.97	52.78	0.19

KS200C 0.5%+5FHD 0.5%

0.5%	Hz	TT	DF	PT
1.0 T	98.76	77.44	76.48	0.96
1.5 T	99.41	68.25	67.85	0.40
2.0 T	99.56	61.46	61.19	0.27
2.5 T	99.64	56.12	55.92	0.20
3.0 T	99.67	51.57	51.40	0.17

KS200C 0.5%+5FHD 0.75%

0.5%	Hz	TT	DF	PT
1.0 T	99.01	76.38	75.62	0.76
1.5 T	99.45	67.56	67.19	0.37
2.0 T	99.59	60.56	60.31	0.25
2.5 T	99.66	55.27	55.08	0.19
3.0 T	99.67	50.95	50.78	0.17

KS200C 1.0%+5FHD 0.25%

0.5%	Hz	TT	DF	PT
1.0 T	99.53	68.07	67.75	0.32
1.5 T	99.66	59.64	59.44	0.20
2.0 T	99.70	54.13	53.97	0.16
2.5 T	99.72	50.31	50.17	0.14
3.0 T	99.72	46.93	46.80	0.13

KS200C 1.0%+5FHD 0.5%

0.5%	Hz	TT	DF	PT
1.0 T	99.54	67.74	67.43	0.31
1.5 T	99.66	59.20	59.00	0.20
2.0 T	99.72	53.69	53.54	0.15
2.5 T	99.72	49.85	49.71	0.14
3.0 T	99.72	46.55	46.42	0.13

KS200C 1.0%+5FHD 0.75%

0.5%	Hz	TT	DF	PT
1.0 T	99.61	66.11	65.85	0.26
1.5 T	99.69	57.89	57.71	0.18
2.0 T	99.70	53.07	52.91	0.16
2.5 T	99.72	49.29	49.15	0.14
3.0 T	99.72	45.81	45.68	0.13

KS200C 1.5%+5FHD 0.25%

0.5%	Hz	TT	DF	PT
1.0 T	99.67	61.39	61.19	0.20
1.5 T	99.73	54.84	54.69	0.15
2.0 T	99.72	50.88	50.74	0.14
2.5 T	99.75	47.20	47.08	0.12
3.0 T	99.73	44.15	44.03	0.12

KS200C 1.5%+5FHD 0.5%

0.5%	Hz	TT	DF	PT
1.0 T	99.70	60.69	60.51	0.18
1.5 T	99.72	54.44	54.29	0.15
2.0 T	99.74	50.50	50.37	0.13
2.5 T	99.74	46.80	46.68	0.12
3.0 T	99.73	43.74	43.62	0.12

• Measure optical properties using NDH5000 ISO mode

Characteristic of Diasphere® for Lighting Plate

Optical Properties of Diffusing Plate with KS-200C and MH-5FHD in PS Matrix

KS-200C

0.5%	Hz	TT	DF	PT
1.0 T	97.66	80.93	79.04	1.89
1.5 T	99.17	71.95	71.35	0.60
2.0 T	99.45	66.00	65.64	0.36
2.5 T	99.56	59.34	59.08	0.26
3.0 T	99.64	56.01	55.81	0.20

1.0%	Hz	TT	DF	PT
1.0 T	99.41	72.47	72.04	0.43
1.5 T	99.64	63.40	63.17	0.23
2.0 T	99.71	57.77	57.60	0.17
2.5 T	99.72	53.02	52.87	0.15
3.0 T	99.74	49.93	49.80	0.13

1.5%	Hz	TT	DF	PT
1.0 T	99.64	66.39	66.15	0.24
1.5 T	99.72	69.67	59.50	0.17
2.0 T	99.75	55.05	54.91	0.14
2.5 T	99.75	51.44	51.31	0.13
3.0 T	99.73	48.72	48.59	0.13

2.0%	Hz	TT	DF	PT
1.0 T	99.71	61.56	61.38	0.18
1.5 T	99.75	56.64	56.50	0.14
2.0 T	99.74	52.87	52.73	0.14
2.5 T	99.74	49.68	49.55	0.13
3.0 T	99.74	46.79	46.67	0.12

MH-5FHD

0.5%	Hz	TT	DF	PT
1.0 T	90.18	89.75	80.94	8.81
1.5 T	95.29	87.92	83.78	4.14
2.0 T	97.32	85.35	83.06	2.29
2.5 T	98.22	82.39	80.92	1.47
3.0 T	98.97	75.89	75.11	0.78

1.0%	Hz	TT	DF	PT
1.0 T	96.97	88.53	85.85	2.68
1.5 T	98.48	84.27	82.99	1.28
2.0 T	99.03	79.65	78.88	0.77
2.5 T	99.28	74.54	74.00	0.54
3.0 T	99.43	68.87	68.48	0.39

1.5%	Hz	TT	DF	PT
1.0 T	98.36	86.04	84.63	1.41
1.5 T	99.13	79.30	78.61	0.69
2.0 T	99.37	73.30	72.84	0.46
2.5 T	99.49	66.91	66.57	0.34
3.0 T	99.57	60.94	60.68	0.26

2.0%	Hz	TT	DF	PT
1.0 T	98.93	82.97	82.08	0.89
1.5 T	99.38	74.27	73.81	0.46
2.0 T	99.54	67.30	66.99	0.31
2.5 T	99.61	61.40	61.16	0.24
3.0 T	99.63	56.44	56.23	0.21

KS-200C+MH-5FHD 50/50 Mixture

0.5%	Hz	TT	DF	PT
1.0 T	94.95	86.69	82.31	4.38
1.5 T	97.95	81.28	79.61	1.67
2.0 T	98.84	76.52	75.63	0.89
2.5 T	99.23	71.16	70.61	0.55
3.0 T	99.40	66.42	66.02	0.40

1.0%	Hz	TT	DF	PT
1.0 T	98.93	78.50	77.66	0.84
1.5 T	99.44	70.03	69.64	0.39
2.0 T	99.62	62.62	62.38	0.24
2.5 T	99.65	57.38	57.18	0.20
3.0 T	99.68	53.11	52.94	0.17

1.5%	Hz	TT	DF	PT
1.0 T	99.53	70.40	70.07	0.33
1.5 T	99.67	62.70	62.49	0.21
2.0 T	99.72	56.96	56.80	0.16
2.5 T	99.74	53.08	52.94	0.14
3.0 T	99.74	49.36	49.23	0.13

2.0%	Hz	TT	DF	PT
1.0 T	99.63	67.16	66.91	0.25
1.5 T	99.72	59.64	59.47	0.17
2.0 T	99.73	54.79	54.64	0.15
2.5 T	99.75	51.42	51.29	0.13
3.0 T	99.73	48.81	48.68	0.13

• Measure optical properties using NDH5000 ISO mode

Characteristic of Diasphere® for Lighting Plate

Optical Properties of Diffusing Plate with KS-200C in PMMA Matrix

KS-200C, PMMA Matrix

0.5%	Hz	TT	DF	PT
1.0 T	92.81	93.15	86.45	6.70
1.5 T	96.42	92.49	89.18	3.81
2.0 T	97.62	91.34	89.17	2.17
2.5 T	98.18	89.93	88.29	1.64
3.0 T	98.69	87.08	85.94	1.14

1.0%	Hz	TT	DF	PT
1.0 T	97.91	91.39	89.48	1.91
1.5 T	98.76	87.77	86.68	1.09
2.0 T	99.18	82.43	81.75	0.68
2.5 T	99.31	78.17	77.63	0.54
3.0 T	99.44	73.24	72.83	0.41

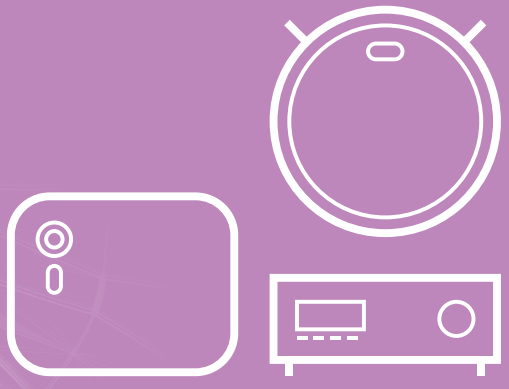
1.5%	Hz	TT	DF	PT
1.0 T	98.77	88.44	87.35	1.09
1.5 T	99.25	81.84	81.23	0.61
2.0 T	99.45	74.84	74.43	0.41
2.5 T	99.54	69.45	69.13	0.32
3.0 T	99.59	63.52	63.26	0.26

2.0%	Hz	TT	DF	PT
1.0 T	99.15	85.00	84.28	0.72
1.5 T	99.49	74.51	74.13	0.38
2.0 T	99.59	68.32	68.04	0.28
2.5 T	99.63	64.01	63.44	0.24
3.0 T	99.65	59.19	58.98	0.21

• Measure optical properties using NDH5000 ISO mode

Coating

Matting/Texture for Paint and Ink
Anti-slip for Leather coating



Characteristic of Diasphere® for Coating

Functions

- Abrasion & Scratch Resistance
- Surface texturing soft feel effect
- Gloss Control
- Anti-blocking
  (Coefficient of friction control, Dry lubricant effect)

Applications

Paint/Ink and Leather additives

- Texture agent
- Matting agent
- Anti scratch agent
- Rheology control agent etc.

[Plastic Coating]

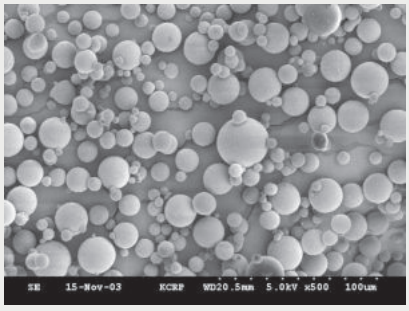
[PCM Coating]

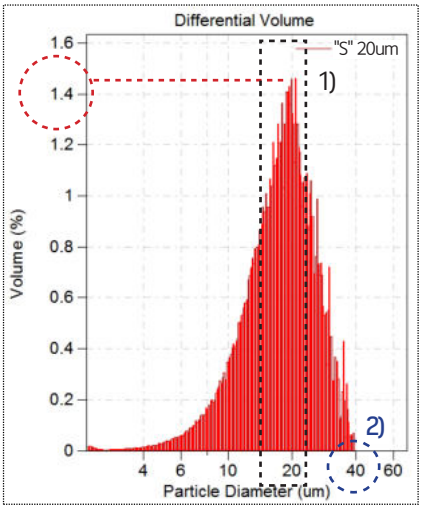
Size Distribution

- Narrow Distribution : Easy to achieve targeting texture
- Control un-expected large size particle : Smooth texture surface

"S" 20um

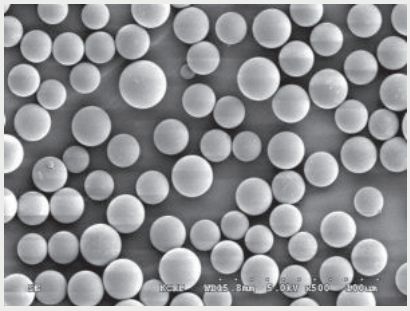
Avg. : 18.4 um
C.V. : 35.3%
D100 : 38um

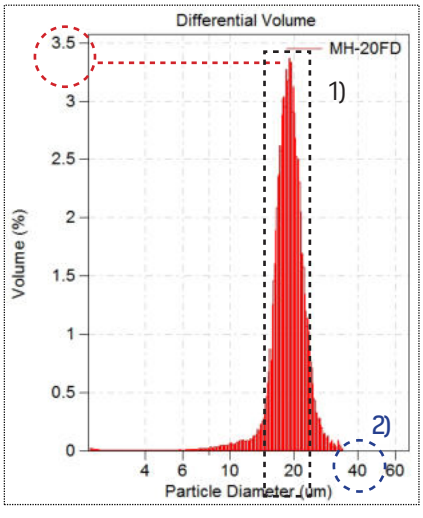




ASP MH-20FD

Avg. : 19.1 um
C.V. : 17.3%
D100 : 35um

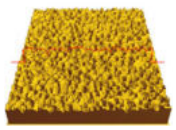
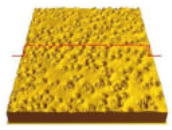
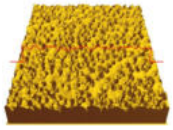
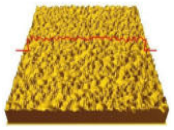
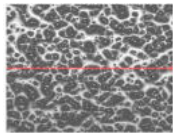
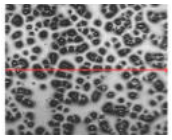
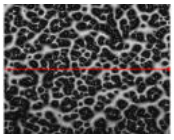
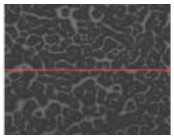
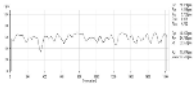
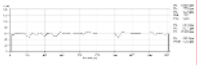
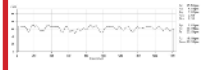
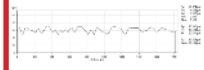




Characteristic of Diasphere® for Coating

Save the Resource

- Same Texture Design, Less than 30% Texture Agents
- Support customer to save the resource

	Competitor 20um(5%)	MH-20FD(2%)	MH-20FD(3.5%)	MH-20FD(5%)
3D				
2D				
Surface Roughness				
Ra	4.448	3.738	4.319	4.69

• Ra : Roughness Average

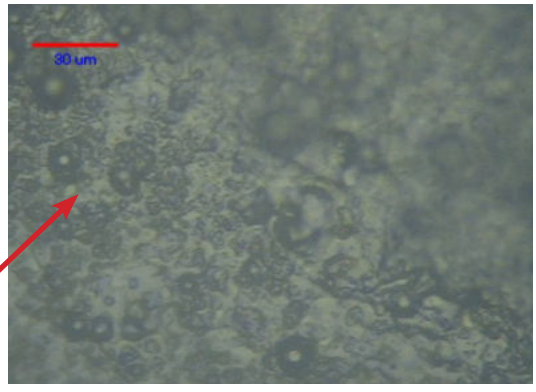
Leather Coating

- To improve the leather surface such as anti-scratch, matting, and processability.
- Recommended grade : MH-5FD, BH-5.

	Component	Size(um)	Softness*		Friction**
MH-5FD	Polymethymethacrylate	5	○	27.0	0.39
BH-5	Polybutylmethacrylate	5	○	10.4	0.39
Silica	Silica	5	●	340	0.50

* Softness : Hard(●) →Soft(○), 10% compression results
** Static friction μ_S (Toyoseiki„ 5% dosage)

Car Seat



Diasphere® MH-5FD

Additive
For Film/Plastic

Anti-Blocking for Film
Anti-Glare for Film
Texturing for plastic surface

Characteristic of Diasphere® for Additives

Functions

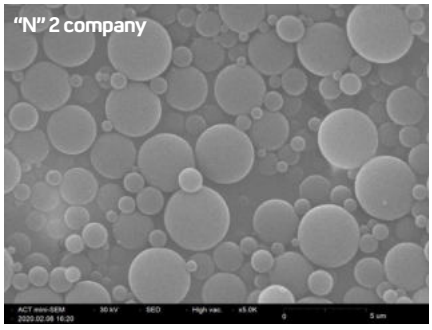
- Anti-blocking(Coefficient of friction control, Dry lubricant effect) for polyolefin films
- Anti-glare effect for various functional films
- Texturing of plastic surface for delustering unique design

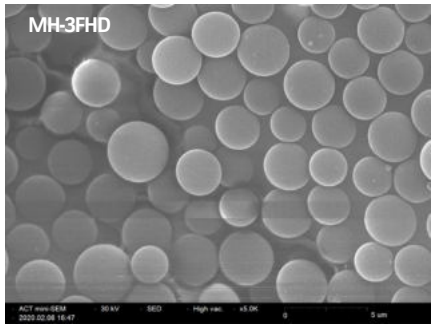
Applications

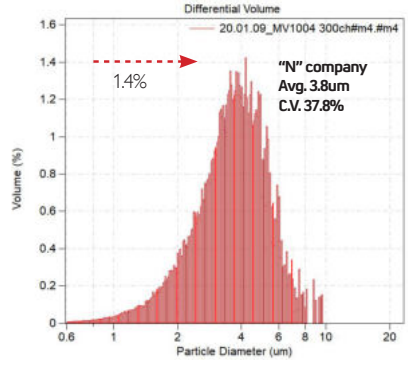
Polyolefin film(BOPP, CPP) for packaging, functional films for electronic devices and several types of plastic(PC, PS, PMMA, ABS)

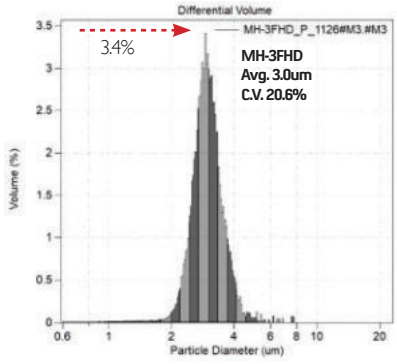
- Matting agent
- Anti blocking agent
- Anti scratch/glare agent
- Rheology control agent etc.

Comparison with competitor

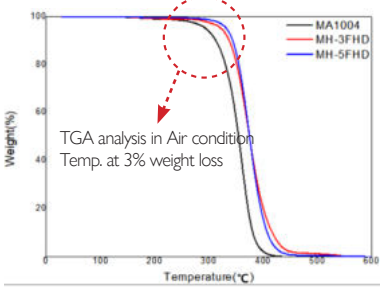








- TGA Analysis in Air

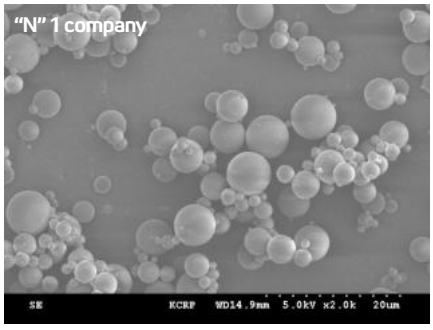


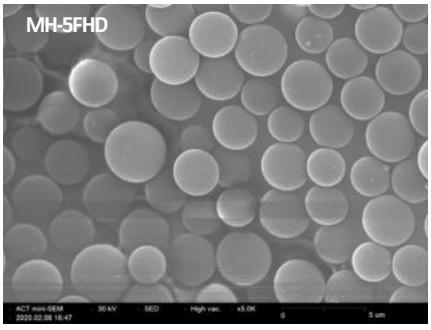
- Temp. at 3% weight loss

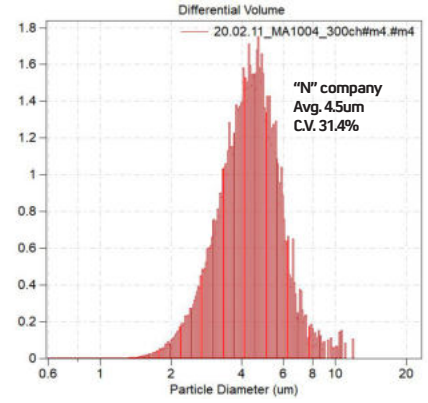
Grade	N2(℃)	Air(℃)
"N" 1	278	
"N" 2		309
MH-3FHD	306	315
MH-5FHD	320	322

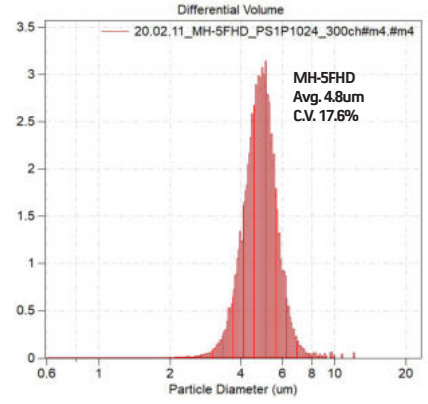
Characteristic of Diasphere® for Additives

Comparison with competitor

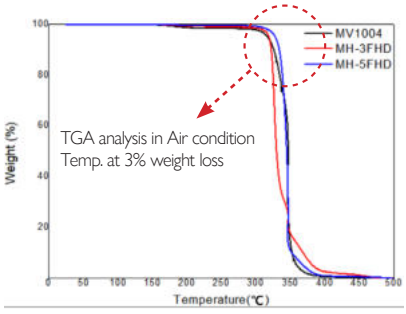








• TGA Analysis in Air



• Temp. at 3% weight loss

Grade	N2(℃)	Air(℃)
"N" 1	278	
"N" 2		309
MH-3FHD	306	315
MH-5FHD	320	322

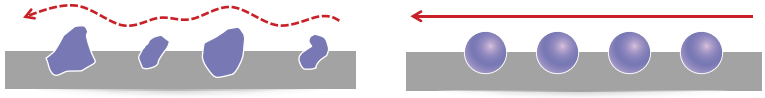
• Furnace test at 300℃ and weight loss ratio after 10min and 20min

	Competitor "N"1	Competitor "N"2	MH-3FHD	MH-5FHD
10min at 300℃				
	1.29%	1.49%	0.6%	0.2%
20min at 300℃				
	15.45%	3.68%	1.6%	1.5%

Characteristic of Diasphere® for Additives

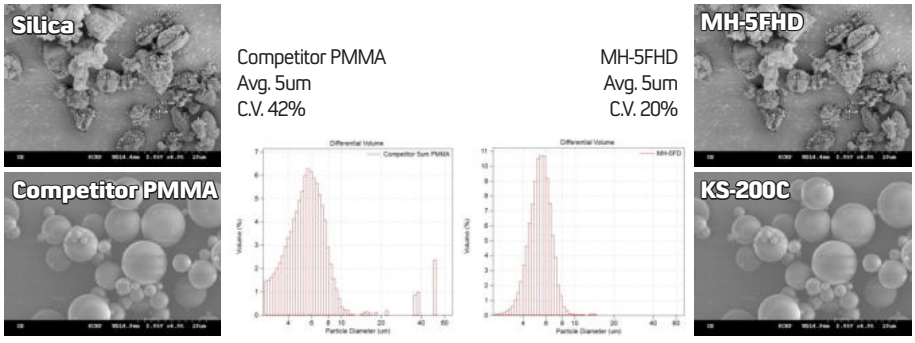
Anti-blocking for Packaging film(BOPP and CPP)

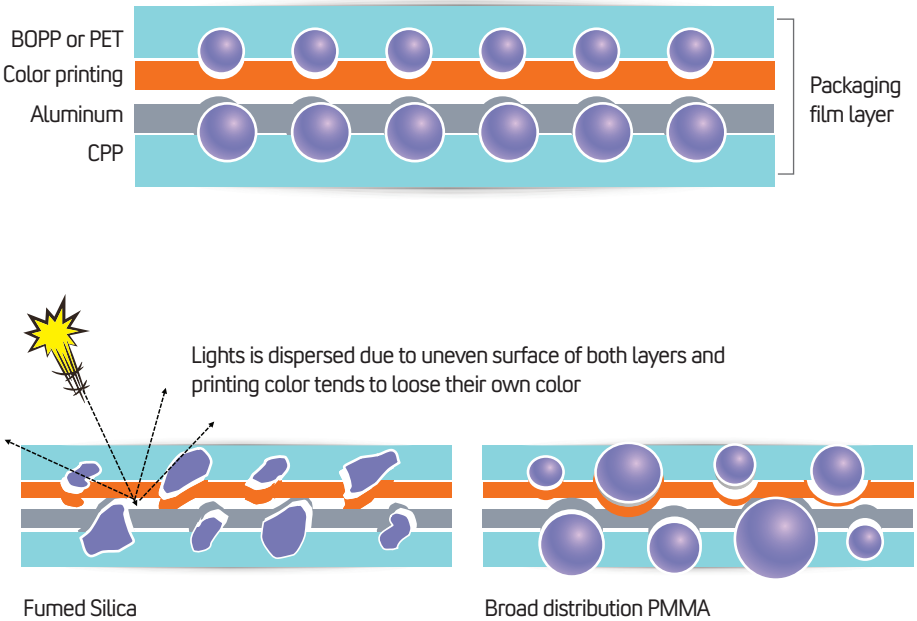
- Very spherical polymer bead lower the static and dynamic friction value.
- Compared with competitor's PMMA and Silica, we have very narrow particle size distribution and spherical shape that leads very smooth protrusion and lower friction value.



Silica
Static friction 0.50us
Dynamic fiction 0.35us

MH-5FHD
Static friction 0.39us
Dynamic friction 0.30us





Characteristic of Diasphere® for Additives

Anti-blocking for film

- Various size and materials can be supplied for the customer's requirement.
- All of the product show the more enhanced friction coefficient.

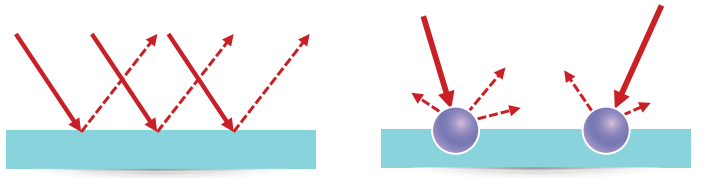
	Component	Size(um)	Softness*		Friction**
MH-3FHD	Polymethymethacrylate	3	◎	27.0	0.39
MH-4FHD	Polymethymethacrylate	4	◎	27.0	0.39
MH-5FHD	Polymethymethacrylate	5	◎	27.0	0.39
BH-5	Polymethymethacrylate	5	○	10.4	0.39
MS-5FHC	Polystyrene	5	◎	25.0	0.39
KS-200C	Polymethylsilsesquioxane	2	○	14.9	0.38
Silica	Silica	5	●	34.0	0.50

* Softness : Hard(●) → Soft(○), 10% compression results

** Static friction/μs(Toyoseiki,, 5% dosage)

Anti-glare coating for film

- We have several types of polymer beads with different refractive index.
- Also, several size polymer beads can be used for Anti-glare effects.



Regular reflection

Diffuse reflection for **Anti glare effect**

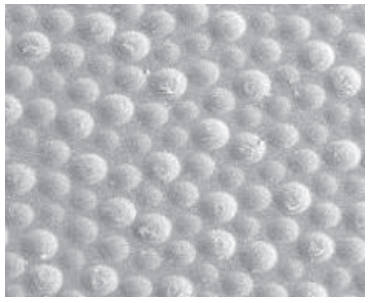
Recommended anti-glare agent

Grade	Particle size	C.V.	Refractive index
MH-3FHD	3um	< 25%	1.49
MH-4FHD	5um	< 20%	1.49
MH-5FD/5FHD	5um	< 20%	1.49
MS-5FHC	5um	< 20%	1.56
KS-200	2um	< 10%	1.42
KS-300	3um	< 10%	1.42
KS-500	5um	< 10%	1.42

Characteristic of Diasphere® for Additives

Texture design of plastic surface in extrusion and casting

- Uniform particle size distribution give even and controlled texture surface of plastic for interior/ exterior of home appliance and car.
- Well dispersed in several types of resin and various size particles from 10um to 80um can be applied in accordance with desired design.



Recommended texture design additives

Grade	Particle size	C.V.	Refractive index
MH-15FD	14um	< 25%	1.49
MH-20FD	20um	< 20%	
MH-25FD	24um	< 20%	
MH-30FD	30um	< 20%	
MH-40FD	40um	< 20%	
MH-60FD	60um	< 20%	
MH-80FD	80um	< 20%	

Cosmetic

Make-up & Powder
Two-way Powder Foundation
Skin care
Sunscreen
Eye Brightener, Lipstick
Pressed Brush Powder
Nail Polish

Characteristic of Diasphere® for Cosmetic Filler

Functions

- Touch modifying agent
- Soft feel effect
- Gloss control
- Concealing effect to hide defects

Applications

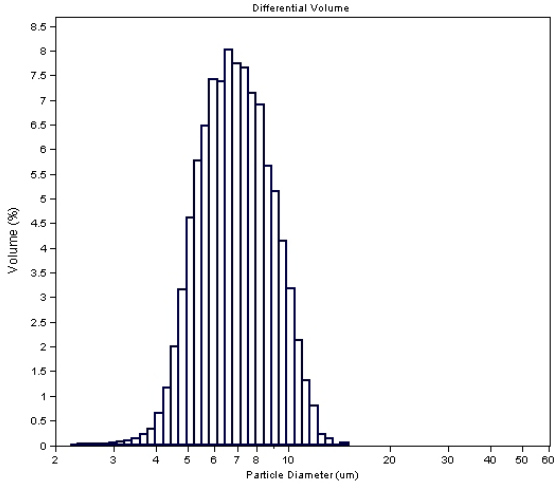
- Make up cosmetic
- Skin care cosmetic
- Personal care cosmetic
- Functional cosmetic

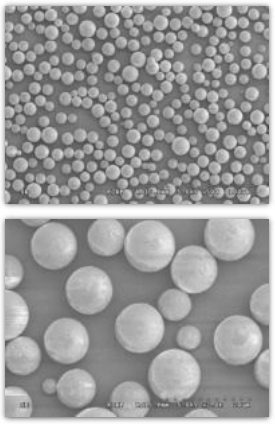
Grades

Description	INCI	Grade	ParticleSize		Remark
			Avg.(㎛)	C.V.(%)	
PMMA	Methyl methacrylate cross polymer	MH-7C	7	<35	Normalbead
		MH-7P	7		Porous bead
		MH-7P++	7		Higher porous bead
Silicone	Polymethylsilses quioxane	KS-200C	2	<20	Silicone bead
		KS-500	5		
		KS-1000	10		
Silica	Silica	KSS-800TE	8	<60	Triethoxycaprylylsilane coating Silica
		KSS-1000	10		Normal Silica

• C.V.(Coefficient of Variance) : Standard deviation/Avg. size

Features of MH-7C(Polymethylmethacrylate)

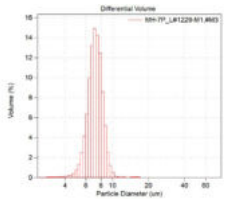
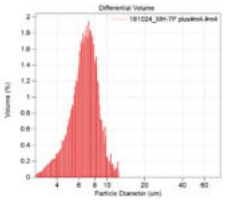
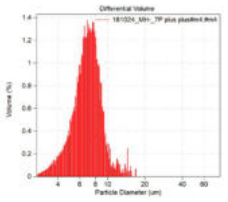
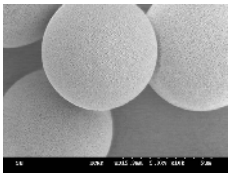
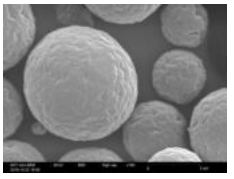
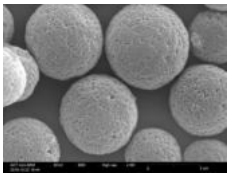




- Average particle size : 7.12㎛
- C.V. : 24.7%

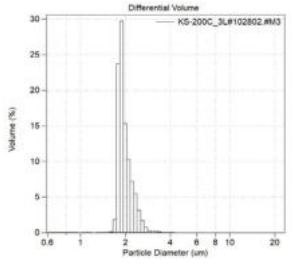
Characteristic of Diasphere® for Cosmetic Filler

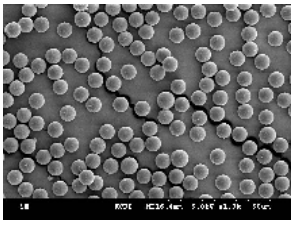
Features of MH-7P(Porous Polymethylmethacrylate)

Name	MH-7P	MH-7P +	MH-7P ++
Particle distribution graph			
Particle size(um)	7.034	6.726	7.000
C.V(%)	16.2	24.4	26.6
Oil absorption(cc/g)	0.65	1.15	1.80
SEM Image (10K)			

Features of KS-Series(Silicone)

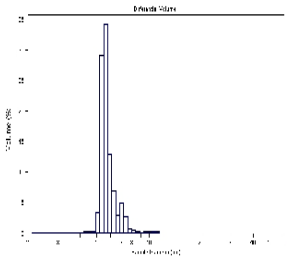
KS-200C

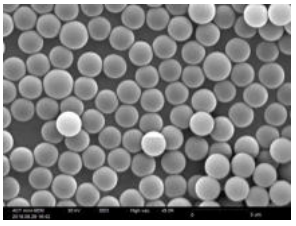




• Avg. size : 2um

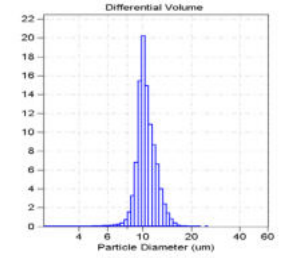
KS-500

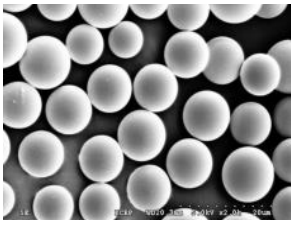




• Avg. size : 5um

KS-1000





• Avg. size : 9um

	pH	Moisture Contents(%)	Oil absorption		
			Liquid Paraffine	Propylen Glycol	Butylene Glycol
Competitor	6.7	0.56/0.58/0.61	0.56g	0.56g	0.72g
KS-500	6.8	0.45/0.52/0.62	0.58g	0.58g	0.69g

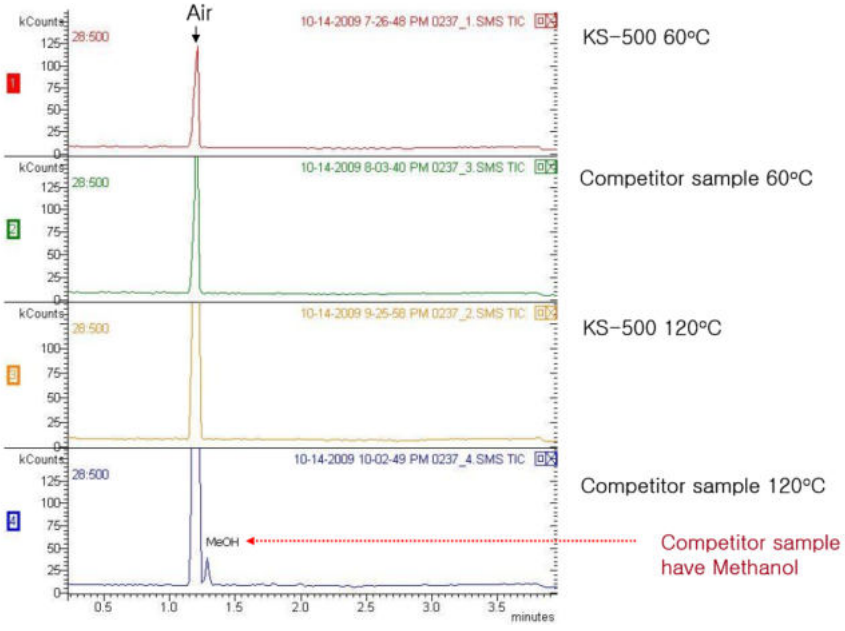
• Moisture Contents : METTLER TOLEDO 120℃ 30min

• Oil Absorption : Wt. of Sample in grams

Characteristic of Diasphere® for Cosmetic Filler

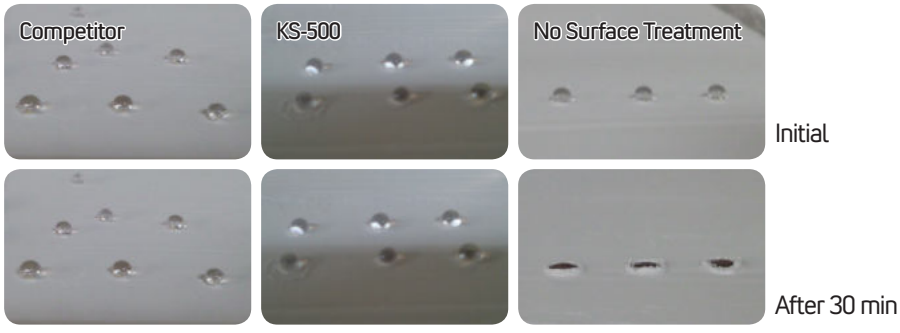
Features of KS-Series(Silicone)

- No Materials detected 60℃, 120℃ in KS-500
- Competitor sample contain MeOH and it comes out 120℃



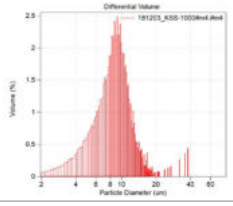
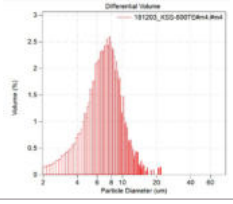
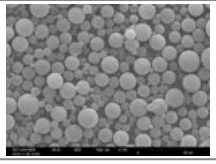
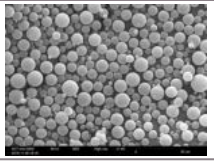
- We spread the powder in a SUS pan by Roller to form a pressed cake.
- Then, a drop of Butylene glycol was applied through a syringe.

	Contact Angle				Average
	1	2	3	4	
Competitor	102.5	98.6	104.8	100.7	101.65
KS-500	113.9	107.4	103.2	110.3	108.7



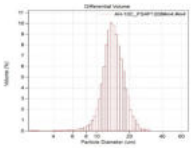
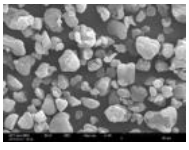
Characteristic of Diasphere® for Cosmetic Filler

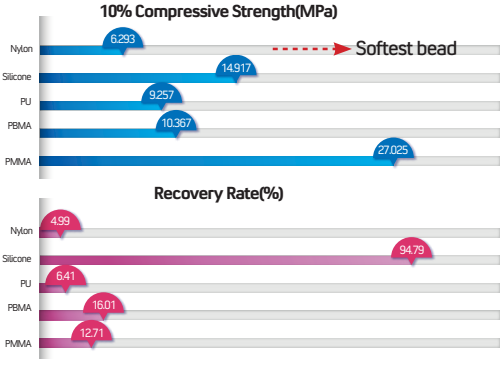
Features of Silica

Name	KSS-1000	KSS-800TE
Particle distribution graph		
Particle size(um)	10.0	8.2
Surface Treatment	-	Triethoxycaprylylsilane
Oil absorption(cc/g)	1.44	1.21
SEM Image(1.0K)		

Features of Nylon 12

• Nylon 12, AH-10C, has relatively narrow size distribution and softest features among several types of organic particles.

Name	AH-10C
Particle distribution graph	
Particle size(um)	10.0
C.V.(%)	22.0
Oil absorption(cc/g)	1.0
SEM Image (1.0K)	



Test Method

• K-Value(10% Compressive Strength): Test Force-19.60mN, Loading Speed-0.892mN/sec

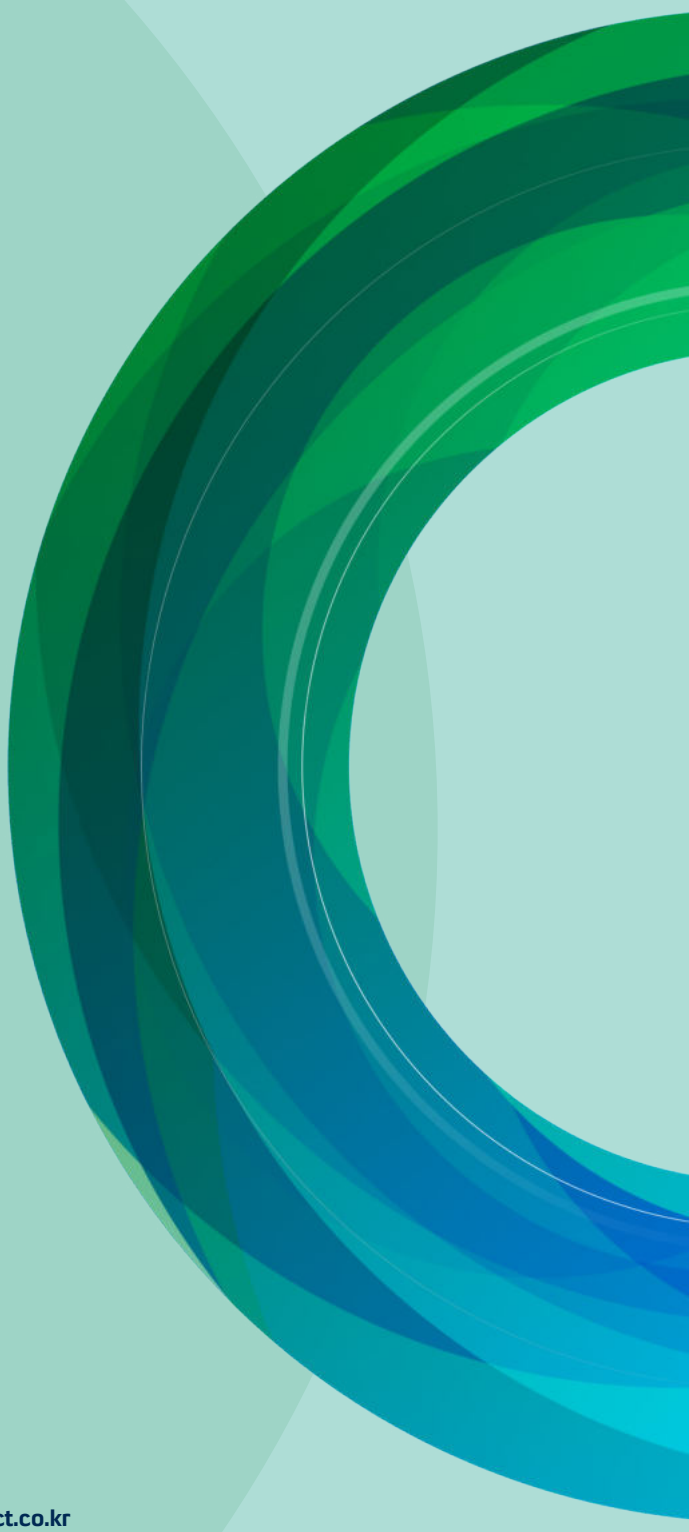
• Compression Recovery Rate : Maximun Force-9.810mN, Minimum Force-0.49mN Loading Speed-0.892mN/sec

Spreadability Test Results

Diasphere®

is Organic Polymer Bead of ASP

www.aspact.co.kr



에이에스피
Advanced Specialty Polymer

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