FUNCTIVE

Chemical resistance enhancer of ABS resin and PC/ABS alloy

Features

- ✓ Imparts chemical resistance to ABS and PC/ABS alloys with low dosage
- ✓ Minimal effect on mechanical properties due to low dosage

Sanyo Chemical

Topics

Sanyo Chemical

1. Chemical resistance tests
    1-1. Appearance
    1-2. Stress cracking test
    1-3. Test method
2. Mechanical properties
3. Mechanism
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1-1. Appearance

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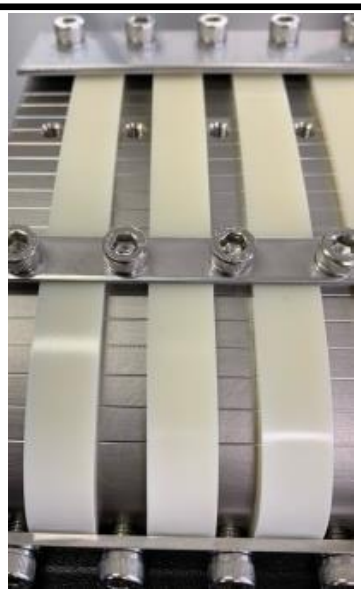
Addition of a small amount of FUNCTIVE improves the chemical resistance of ABS and PC/ABS alloys.

Before test	After test	
ABS	ABS	ABS / FUNCTIVE P-600 (95 / 5 wt/wt)
		

Materials

According to the above table, each of the compounds was kneaded using a single screw extruder at 250°C, and then molded using an injection molding machine(nozzle temp.: 250°C, mold temp.:50°C).

ABS and FUNCTIVE were dried at 80°C for 3hours.

Test method

The injection-molded test piece was fixed on the ¼-oval test piece described on page 8 and 9, and chemicals (detergent for clothes:Attack Neo Antibacterial EXW Power) were applied to it. The samples were left for 20 hours under the condition of 23°C and 50RH%, and the photos were taken before and after test, respectively.

1-2. Stress cracking test (ABS resin)

Sanyo Chemical

Addition of FUNCTIVE improves the chemical resistance of ABS resin.

Test chemicals	Amount of FUNCTIVE added (%)				
	blank	Y-200	P-600	Y-200 P-600	Y-200 P-600
	0	5	5	2.5/2.5	5/5
Gasoline	1	4	2	3	4
Ethanol	2	2	3	3	4
Laundry detergent (slightly acidic)*1	1	2	3	3	4
Bathroom cleaners (neutral) *2	1	2	3	3	4
Sunscreen*3	3	3	4	3	3

Test method

The injection-molded test piece was fixed on the ¼-oval test piece described on page 8 and 9, and chemicals were applied to it. The samples were left for 20 hours under the condition of 23°C and 50RH%, and the critical strain value (ε) was calculated from the crack occurrence position.

- Critical strain value 1： Poor chemical resistance （ε<0.7）
- Critical strain value 2： Average chemical resistance （0.7≦ε<0.8）
- Critical strain value 3： Good chemical resistance （0.8≦ε）
- Critical strain value 4： Excellent chemical resistance （No cracks）

*1: Attack Neo Antibacterial EXW Power (Kao)　*2: Bathmagiclean (Kao)　*3: Neutrogena(SPF55)

1-2. Stress cracking test (PC/ABS alloy)

Sanyo Chemical

Addition of FUNCTIVE improves the chemical resistance of ABS resin.

Test chemicals	Amount of FUNCTIVE added (%)				
	blank	Y-200	P-600	Y-200 P-600	Y-200 P-600
	0	5	5	2.5/2.5	5/5
Gasoline	1	1	1	1	2
Ethanol	2	2	2	2	3
Laundry detergent (slightly acidic)*1	1	3	1	1	3
Bathroom cleaners (neutral) *2	3	3	3	3	4
Sunscreen*3	1	1	3	1	3

Test method

The injection-molded test piece was fixed on the ¼-oval test piece described on page 8 and 9, and chemicals were applied to it. The samples were left for 20 hours under the condition of 23°C and 50RH%, and the critical strain value (ε) was calculated from the crack occurrence position.

- Critical strain value 1： Poor chemical resistance （ε<0.7）
- Critical strain value 2： Average chemical resistance （0.7≦ε<0.8）
- Critical strain value 3： Good chemical resistance （0.8≦ε）
- Critical strain value 4： Excellent chemical resistance （No cracks）

*1: Attack Neo Antibacterial EXW Power (Kao)　*2: Bathmagiclean (Kao)　*3: Neutrogena(SPF55)

1-2. Stress cracking test (Transparent ABS resin)

Sanyo Chemical

Addition of FUNCTIVE improves the chemical resistance of ABS resin.

Test chemicals	Amount of FUNCTIVE added (%)	
	blank	P-600
	0	5
Ethanol	1	4
Laundry detergent (slightly acidic)*1	2	3
Bathroom cleaners (neutral) *2	2	3
Sunscreen*3	2	3

Test method

The injection-molded test piece was fixed on the ¼-oval test piece described on page 8 and 9, and chemicals were applied to it. The samples were left for 20 hours under the condition of 23°C and 50RH%, and the critical strain value (ε) was calculated from the crack occurrence position.

- Critical strain value 1： Poor chemical resistance （ε<0.4）
- Critical strain value 2： Average chemical resistance （0.4≦ε<0.5）
- Critical strain value 3： Good chemical resistance （0.5≦ε）
- Critical strain value 4： Excellent chemical resistance （No cracks）

*1: Attack Neo Antibacterial EXW Power (Kao)

*2: Bathmagiclean (Kao)

*3: Neutrogena(SPF55)

1-2. Stress cracking test (Transparent ABS resin)

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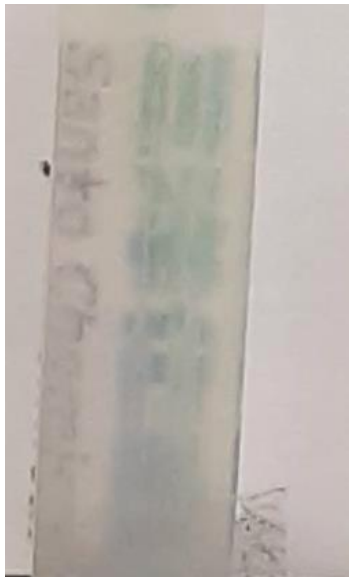
Transparency can be maintained by adding FUNCTIVE.

Before test		After test*1	
blank	FUNCTIVE P-600 5%	blank	FUNCTIVE P-600 5%
			

*1: Attack Neo Antibacterial EXW Power (Kao)

1-3. Test method

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ABS

Materials

Each of the compounds was kneaded using a single screw extruder at 250°C, and then molded using an injection molding machine(nozzle temp.: 250°C, mold temp.:50°C).

ABS resin and FUNCTIVE were dried at 80°C for 3hours.

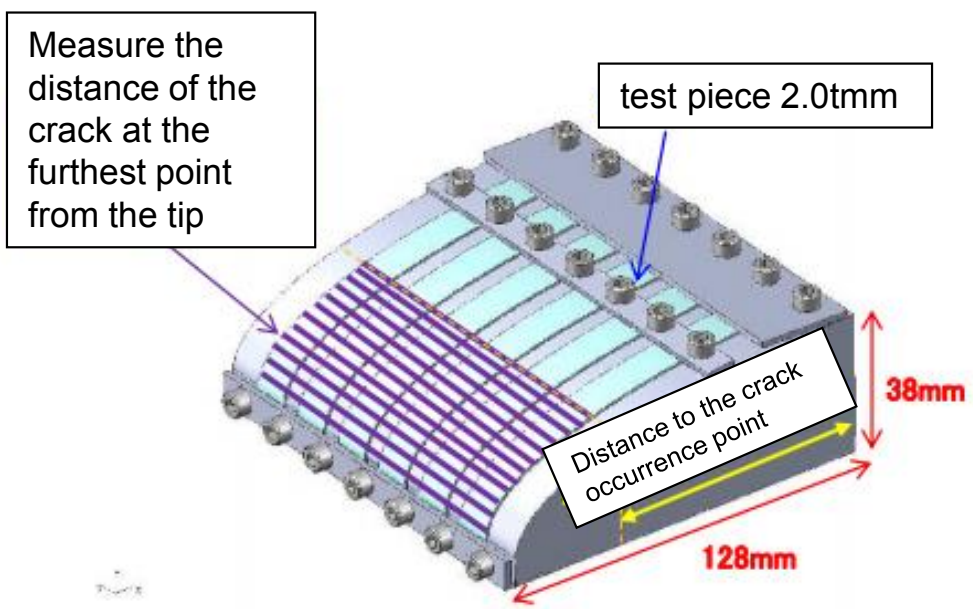
PC/ABS

Materials

Each the compounds was kneaded using a single screw extruder at 250°C, and then molded using an injection molding machine(nozzle temp.: 250°C, mold temp.:90°C).

PC/ABS alloy and FUNCTIVE were dried at 100°C for 4hours and 80°C for 3hours respectively.

1-3. Test method



$$\varepsilon = \frac{b}{2a^2} \times \left\{ 1 - \frac{(a^2 - b^2)\, h^2}{a^4} \right\}^{-3/2} \times t \times 100$$

ε : Critical strain value(%)
a : Long side of the ellipse (mm)
b : Short side of the ellipse(mm)
t : Thickness of test piece (mm)
h : Crack occurrence point (mm)

Test method

The injection-molded test piece is fixed on the ¼-oval test fixture as shown in the above figure, and test chemicals are applied to it. The samples were left for 20 hours under the condition of 23°C and 50RH%, and the critical strain value (ε) was calculated from the crack occurrence position.

The higher the value, the higher the chemical resistance.

2. Mechanical properties (ABS resin)

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The effect of the FUNCTIVE on the mechanical properties of the resin is minimal.

Test items		Amount of FUNCTIVE added (%)				
		blank	Y-200	P-600	Y-200 P-600	Y-200 P-600
		0	5	5	2.5/2.5	5/5
Flexural strength	(MPa)	76	72	73	74	68
Flexural modulus	(GPa)	2.4	2.4	2.4	2.3	2.2
Tensile strength	(MPa)	51	44	49	48	45
Izod impact strength	(J/m)	280	90	170	90	80
MFR	(g/10min)	20	20	33	22	27

Materials

According to the above table, each of the compounds was kneaded using a single screw extruder at 250°C, and then molded using an injection molding machine (nozzle temp.: 250°C, mold temp.:50°C).

ABS resin and FUNCTIVE were dried at 80°C for 3hours.

Test method

Flexural test：ASTM D790, Tensile test：ASTM D638, Izod impact strength：ASTM D256 (with notch)

MFR：ASTM D1238 (220°C, 10kgf)

2. Mechanical properties (PC/ABS alloy)

Sanyo Chemical

The effect of the FUNCTIVE on the mechanical properties of the resin is minimal.

Test items		Amount of FUNCTIVE added (%)				
		blank	Y-200	P-600	Y-200 P-600	Y-200 P-600
		0	5	5	2.5/2.5	5/5
Flexural strength	(MPa)	81	74	76	73	69
Flexural modulus	(GPa)	2.1	2.0	2.0	1.9	1.8
Tensile strength	(MPa)	54	49	51	49	47
Izod impact strength	(J/m)	640	330	530	540	500
MFR	(g/10min)	11	38	15	18	45

Materials

According to the above table, each of the compounds was kneaded using a single screw extruder at 250°C, and then molded using an injection molding machine (nozzle temp.: 250°C, mold temp.:90°C).

PC/ABS alloy and FUNCTIVE were dried at 100°C for 4hours and 80°C for 3hours respectively.

Test method

Flexural test：ASTM D790, Tensile test：ASTM D638, Izod impact strength：ASTM D256 (with notch)

MFR：ASTM D1238 (220°C, 10kgf)

3. Mechanism (interfacial reinforcement)

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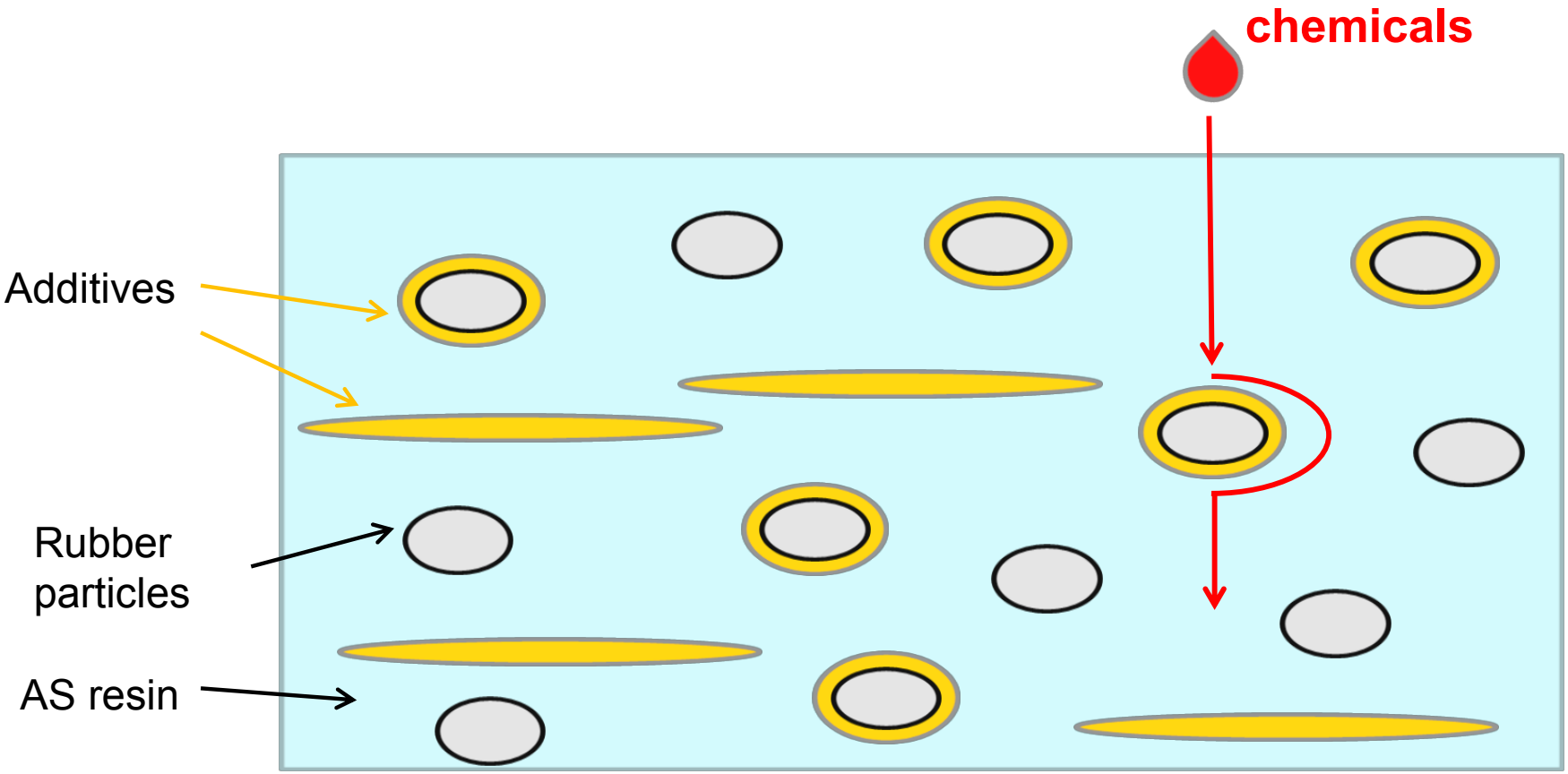
FUNCTIVE prevents chemical penetration into the rubber, thereby improving the chemical resistance.



4. Typical properties

	FUNCTIVE Y-200	FUNCTIVE P-600
Appearance	Yellow granule	Yellow
Melting point (^{o}C)	135	203
Molecular weight (Mw)	Approx. 30,000	Approx. 30,000

Test method
Melting point：DSC method, Molecular weight：High temperature GPC method

5. Processing flowchart

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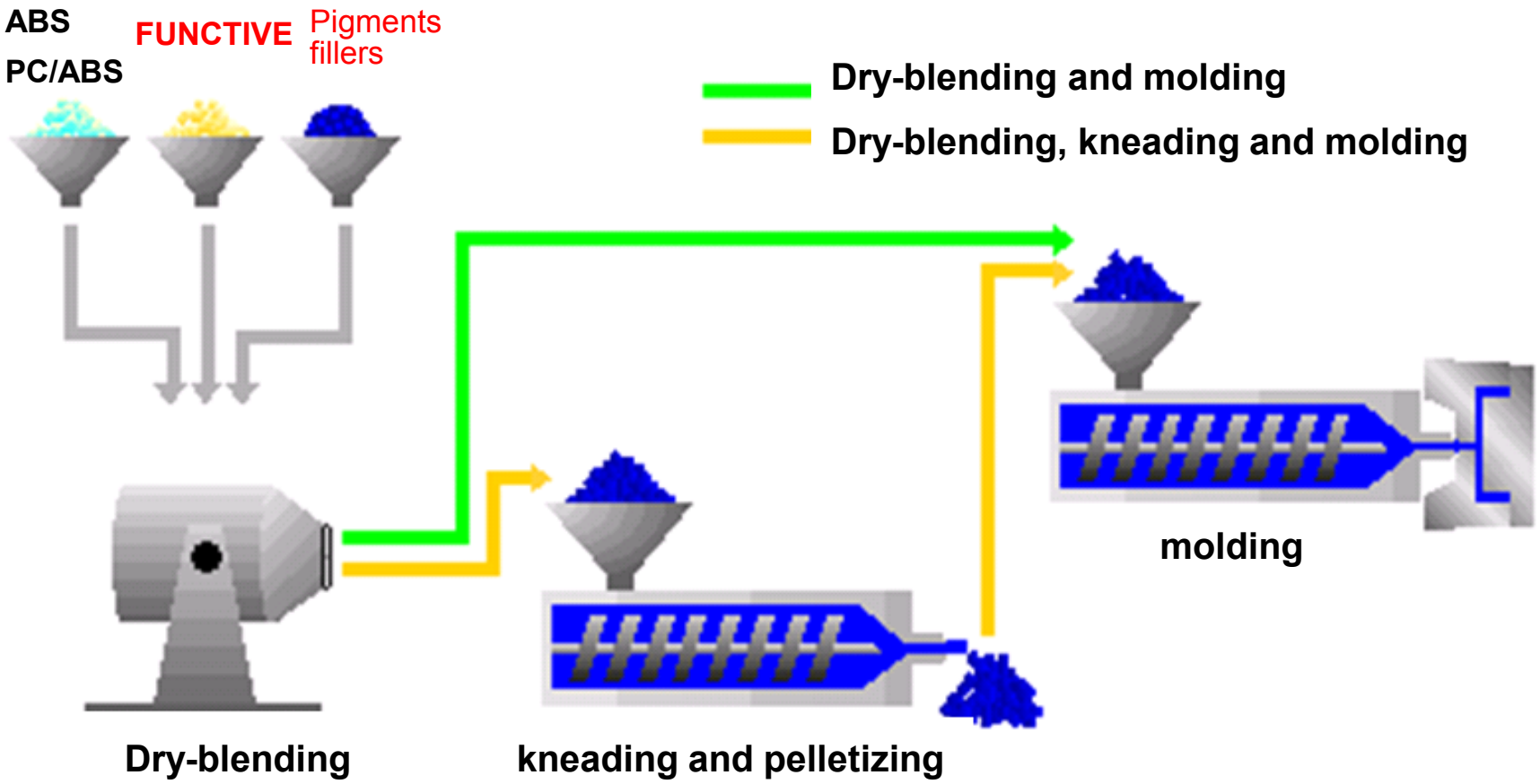
The chemical resistance improver, FUNCTIVE, can be mixed into resins under the same conditions as pigments and fillers.



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