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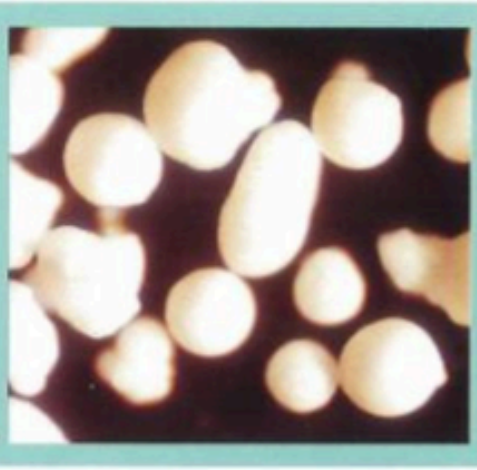
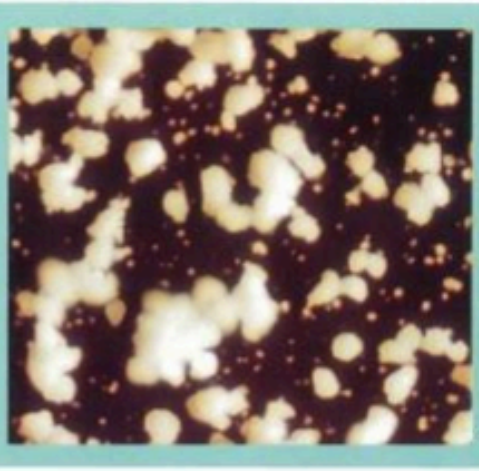
I. Powder Properties of KANE ACE PA-2(

Powder form

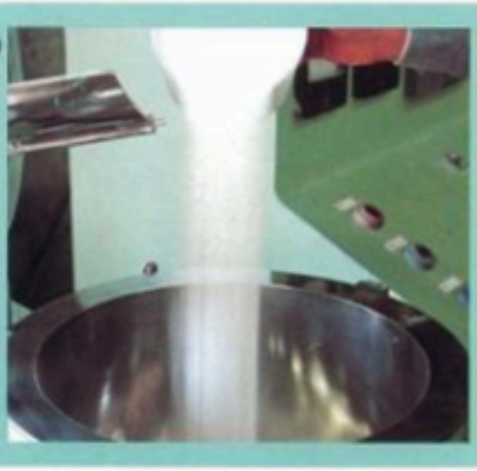


Improved type



Conventional type

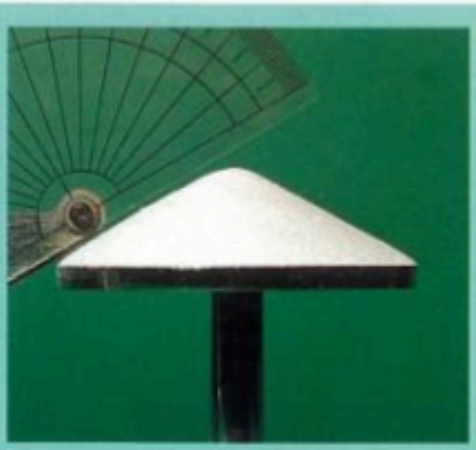
Charging into blender



Improved type

Conventional type

Free flow properties



Improved type

Conventional type

Appearance	: White powder
Bulk density	: More than 0.35
Particle size	: 100% pass through 16-mesh sieve
Volatile matter	: Less than 1.5% (at 105°C × 60 minu

SYNERGY

KANE ACE PA-20 Compounds

ensile Strength and Elongation

n of KANE ACE PA-20 tends to increase tensile h and elongation. Elongation sharply increases, par- y at high temperatures.

1

em ature (°C) / (PHR)	Tensile strength (kg/cm²) 23	80	100	120	Elongation (%) 23	80	100	120
0	615	200	51	21	160	325	265	171
5	636	236	60	25	165	380	481	280
10	644	242	64	26	164	405	579	387

Recipe: (*kv: 1% cyclohexanone)

Kanevinyl S-1008 (*kv = 59-61)	:	100 PHR
Dibutyl tin maleate	:	3.0 PHR
Monoglyceride stearate	:	1.0 PHR
Low molecular weight polyethylene wax	:	0.1 PHR
KANE ACE PA-20	:	Variable (0/5/10)

Specimen Preparation:
Rolls (8 inches)..... 5 minutes at 165°C
Press (50 kg/cm²)..... 10 minutes at 175°C
Test Method: JIS K-6745
Pulling speed: 100 mm/min except at 23°C at which the specimen is pulled at 10 mm/minute.

Heating Deformation Temperature

esistance tends to increase as KANE ACE PA-20 is . The results of measuring heating deformation ratures are shown below.

e: Same as in Table 1.
men Preparation:
olls (8 inches)..... 5 minutes at 165°C
Press (50 kg/cm²)..... 15 minutes at 175°C
Test Method: ASTM D-1526

Table 2

Item / PA-20 (PHR)	Heating deformation temperature
0	67.5
5	68.3
10	69.4

Workability

lation behavior by Brabender Plasticoder

on of KANE ACE PA-20 increases gelation speed (Table ws the time for reaching the maximum torque as a yard- and slightly raises steady torque. This indicates increas- ation of the compund and easy milling through improv- cosity.

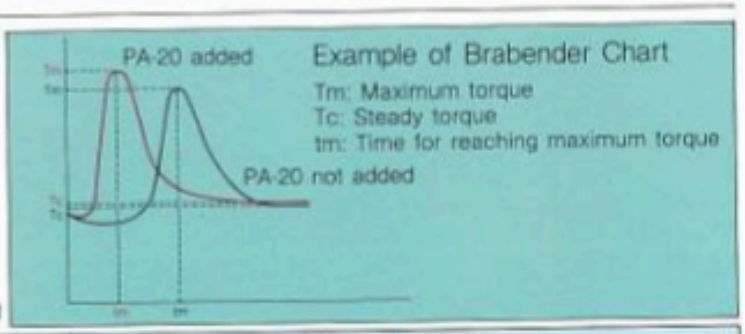


Fig. 1

3

Blend / Item / 20 (PHR)	Tin formulation: Time for reaching maximum torque (sec)	Maximu torque (kg-m)	Steady torque (kg-m)	Resin temperature (°C)	Lead formulation: Time for reaching maximum torque (sec)	Maximum torque (kg-m)	Steady torque (kg-m)	Resin temperature (°C)
0	210	4.05	2.59	193	255	3.80	2.72	196
0.5	125	4.56	2.63	194	195	4.00	2.74	196
1	105	4.80	2.69	194	180	4.37	2.79	196
2	65	5.29	2.74	195	130	4.86	2.82	197
5	35	6.06	2.92	197	90	5.09	2.83	198

e: Tin formulation

inyl S-1007 (*kv = 58)	:	100 PHR
tin mercaptide	:	1.5 PHR
dized soybean oil	:	1.5 PHR
acid ester	:	1.0 PHR
nic acid ester	:	0.5 PHR
ACE PA-20	:	Variable (0 to 5)

(*kv: 1% cyclohexanone)

Recipe: Lead formulation

Kanevinyl S-1008 (*kv = 59-61)	:	100 PHR
Tribasic lead sulphate	:	3.0 PHR
Lead stearate	:	0.7 PHR
Calcium stearate	:	0.5 PHR
KANE ACE PA-20	:	Variable (0 to 5)

(*kv: 1% cyclohexanone)

Test Conditions

Item / Blend	Tin formulation	Lead formulation
Compound weight (g)	55	57
Chamber temperature (°C)	160	170
Rotating speed (r.p.m.)	50	30
Preheating (min)	3	3

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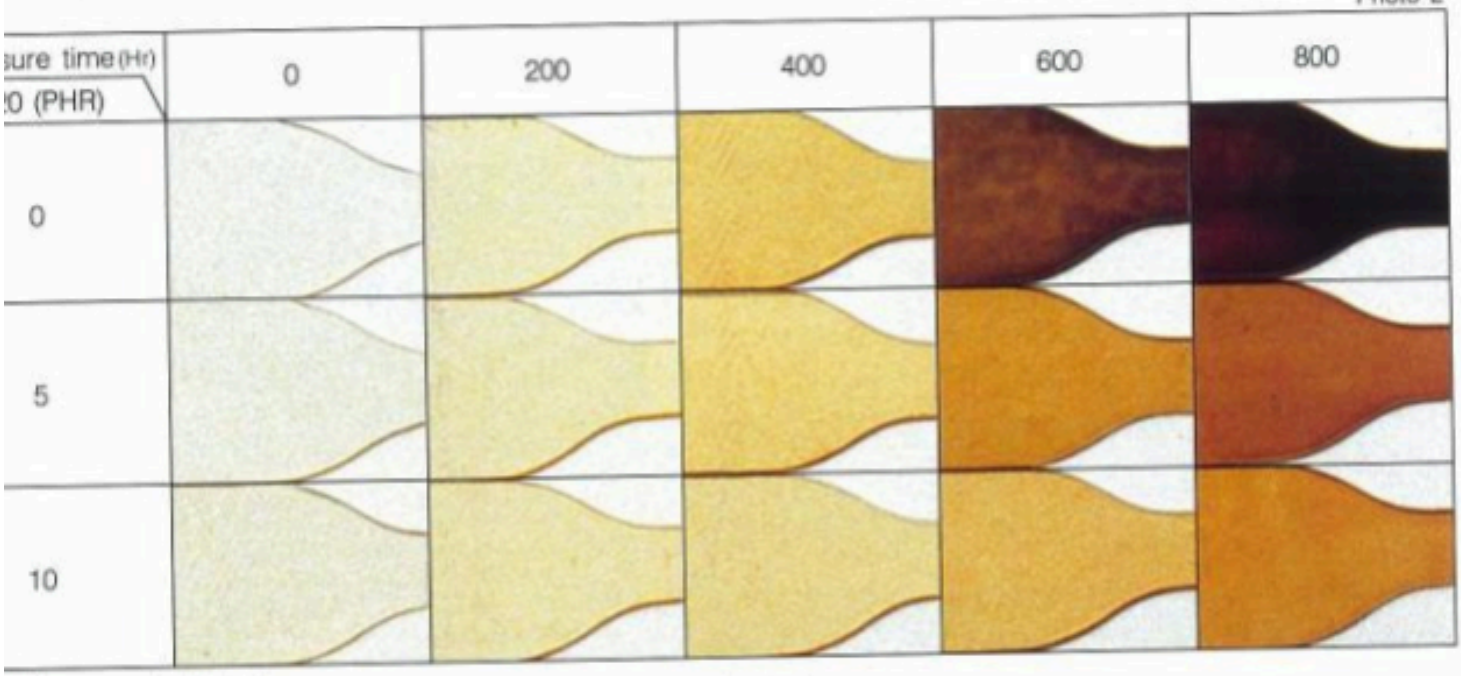
ther Physical Properties

herability

lts of a test on weatherability where KANE ACE PA-20 is added are shown below. Improvement can be seen on resistance loration (deterioration) by weather.

Photo 2



: Same as in Table 1
ien preparation: Same as in Table 1
erability test:
nshine weatherometer
ack panel temperature ..... 63°C
ray cycle ..... 18 minutes/120 minutes
ethod:
: K-6745; pulling speed 10 mm/minute; measuring nperature 23°C

Table 5

Item / Exposure time (Hr) / PA-20 (PHR)	Tensile strength (kg/cm²)				
	0	200	400	600	800
0	615	745	754	530	416
5	636	748	750	552	452
10	644	748	748	548	445

nsparency

ACE PA-20 little adversely affects the transparency : for practical purposes. An example of transparency arison is shown together with a photo.

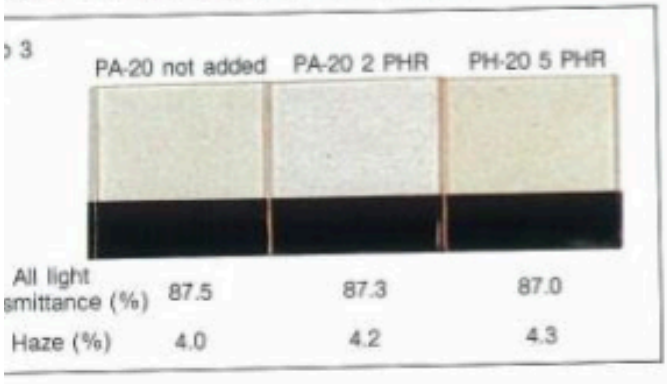


Table 6

Recipe:		(*kv: 1% cyclohexanone)
Kanevinyl S-1008 (*kv = 59-61)	:	100 PHR
Plasticizer (DOP)	:	10 PHR
Barium zinc stabilizer	:	2.0 PHR
Dibutyl tin maleate	:	0.5 PHR
Chelate	:	0.5 PHR
Stearic acid	:	0.5 PHR
KANE ACE PA-20	:	Variable (0/2/5)

Specimen preparation:
Rolls (8 inches) ..... 6 minutes at 160°C
Press (50 kg/cm²) ..... 10 minutes at 170°C
Pressed to 3 mm thick plate
Test method: ASTM D-1003-61

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• Barus Effect by Round Bar Extrusion

Compounds containing KANE ACE PA-20 show a distinctive Barus effect (die swell) by the elastic recovery of molten resins.

Table 4

Item / Screw speed (r.p.m.) / PA-20 (PHR)	Die swell		
	30	60	90
0	1.27	1.34	1.36
1	1.38	1.50	1.61
2	1.47	1.61	1.73
5	1.67	1.88	2.10

Recipe: Same as for tin formulation in Table 3

Measuring instrument:

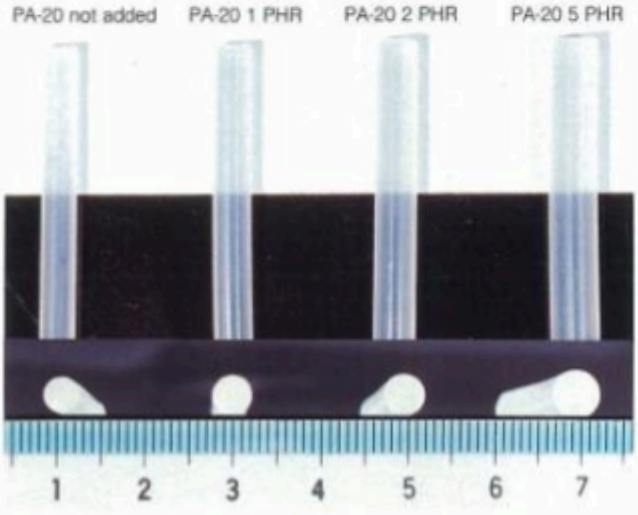
Brabender PLV151 screw type (L/D = 16, C.R. = 2.5), die diameter = 3.0 mm

Extrusion conditions:

C_1 = 155°C, C_2 = 170°C, C_3 = 175°C, Screw speeds = 30, 60, 90 r.p.m.

Die swell values were obtained by the ratio of D (push rod diameter) to D_0 (die diameter).

Photo 1

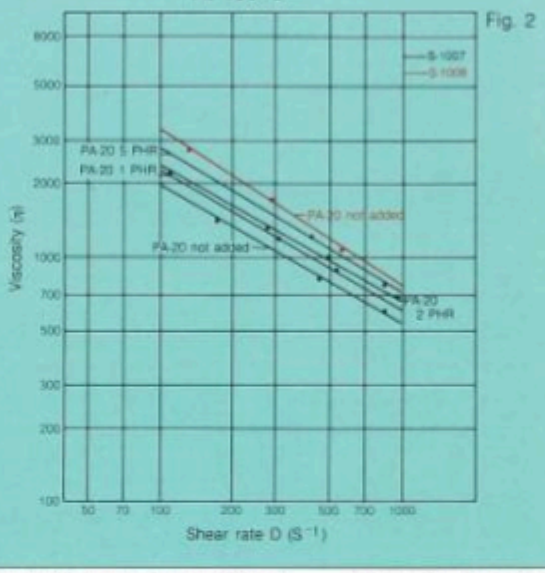


• Viscosity by Rheometer

Addition of KANE ACE PA-20 generally tends to increase melt viscosity to some extent. The behavior of KANE ACE PA-20 added to S-1007 and a comparison of S-1007 with S-1008 are shown below.

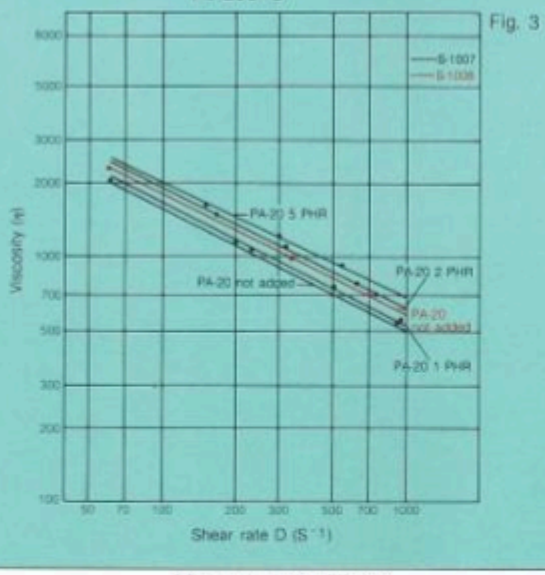
At 190°C

Fig. 2



At 200°C

Fig. 3



Recipe: Same as for tin formulation in Table 3. For comparison, S-1008 (PA-20 not added) was also measured.

Measuring instrument:

High Pressure Capillary Rheometer (Göttfert Feinwerk Technik) HKR•2000

Measuring conditions:

Temperature (°C)	Pressure (bar)
190	100. 150. 200. 250
200	50. 100. 150. 200

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Injection Molding

/C injection molding covers nearly all kinds of products nging from hard to soft and foam, but one of its greatest oblems is faulty looks which are liable to occur due to nited molding width. This problem must be solved in apply- g injection molding to large-sized parts, particularly, those ed for home electric appliances, office equipment, and tomobiles.

ddition of KANE ACE PA-20 by 1 to 5 PHR will:

Sharply improve external looks by eliminating flow marks and silver streaks around the gate

Improve the luster of moldings.

ne general physical properties of moldings will also be proved.

ata on molding elbows are shown below by way of il- strating the effectiveness of KANE ACE PA-20 in injection olding.

xample

ble 7

cipe:

nevinyl S-1008 (*kv = 59-61)	:	100 PHR
tyl tin stabilizer	:	3.0 PHR
ternal lubricant	:	1.5 PHR
ternal lubricant	:	0.7 PHR
anium white	:	0.5 PHR
gment (Ultramarine)	:	0.56 PHR
pact modifier (KANE ACE B-56)	:	7.0 PHR
NE ACE PA-20	:	Variable (0/2/5)

v: 1% cyclohexanone)

end: Blended by super mixer (120°C)

jection molder: Nissei FS-150

olding conditions:

C_1 temperature:	150°C
C_2 temperature:	179°C
C_3 temperature:	182°C
Nozzle temperature:	187°C
Injection pressure P_1:	970 kg/cm^2
Injection pressure P_2:	880 kg/cm^2
Screw speed:	80 r.p.m.
Injection time:	6 sec
Cooling temperature:	40°C
Cooling time:	40 sec

esults:

As shown in Photo 4, a distinctive improvement could be seen, on the external appearance of the

Photo 4

PA-20 not added

PA-20 2 PHR

2 Calendering

In calendering PVC, smooth bank rotation and roll finish in kneading are important factors for assuring high product quality on a constant basis. Generally, PVC processability lowers as its degree of polymerization increases. Also, homopolymers have lower processability than copolymers, and so do soft blends than hard blends. If KANE ACE PA-20 is added, however, the following effects can be achieved, particularly, in hard, leather, and soft applications.

- As shown in Table 3, the increased gelation effect makes the resin flow from the roll bank smooth to improve processability with resultant production of formed sheets having a satisfactory surface.
- The increased gelation effect also facilitates forming of high-blend filler materials.
- Sheet and film widths can be increased, contributing on improving productivity.
- Formed sheets satisfactory for secondary processing can be obtained.
- Improved physical properties, such as greater resistance to discoloration by weather and increased heat resistance, can be expected of the products.

As a way of illustrating the effectiveness of KANE ACE PA-20 for improving gelation and product ouality in rolling, the results of a test conducted on compounds with and without a filler (heavy calcium carbonate) are shown below. For the effects of PA-20 for secondary processing, refer to III-6.

Example

Table 8

Recipe:

Kanevinyl S-1007 (*kv = 58)	:	100 PHR
Octyl tin mercaptide	:	1.5 PHR
Epoxidized soybean oil	:	1.5 PHR
Fatty acid ester lubricant	:	1.0 PHR
Montanic acid ester	:	0.5 PHR
Filler (Heavy calcium carbonate)	:	Variable (0/10)
KANE ACE PA-20	:	Variable (0/2)

(*kv: 1% cyclohexanone)

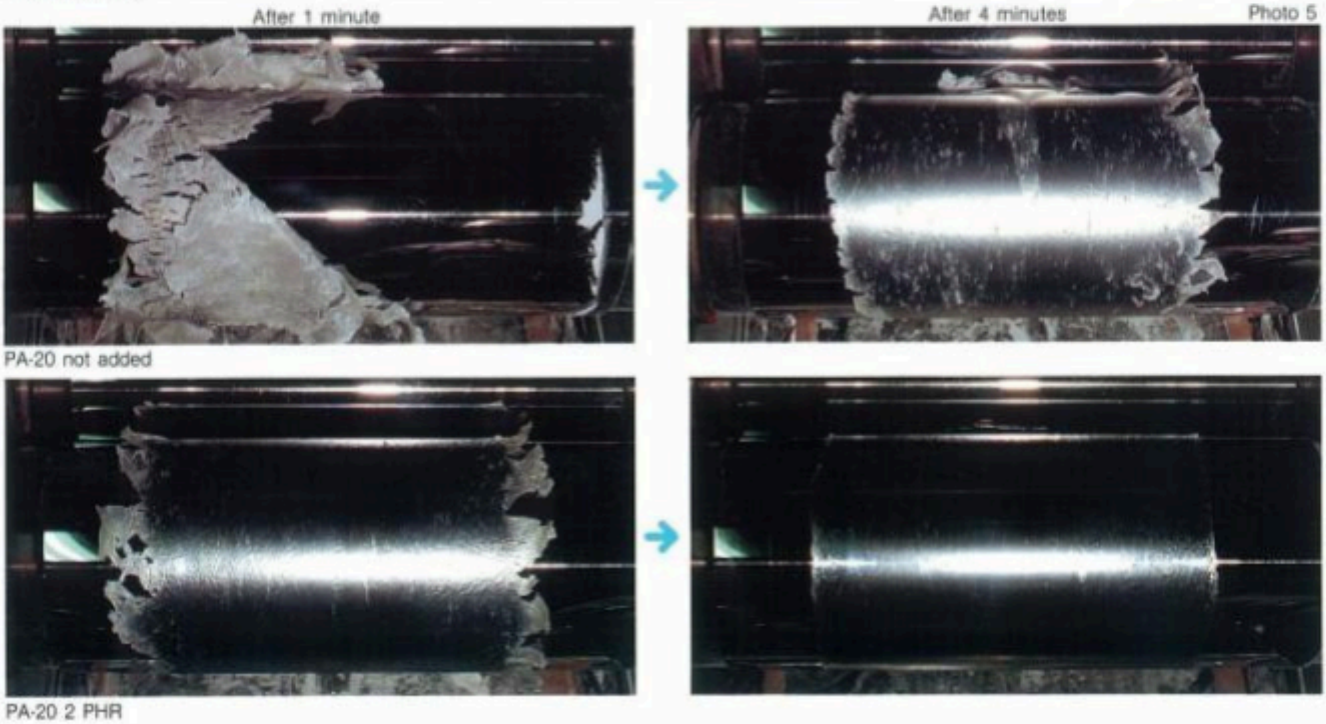
Test method: Rolls (8-inch), temperature 160°C

Kneading time:

Comparison of conditions 1 minute and 4 minutes after charging the compounds (280 grams) was made.

Filler not used

Photo 5

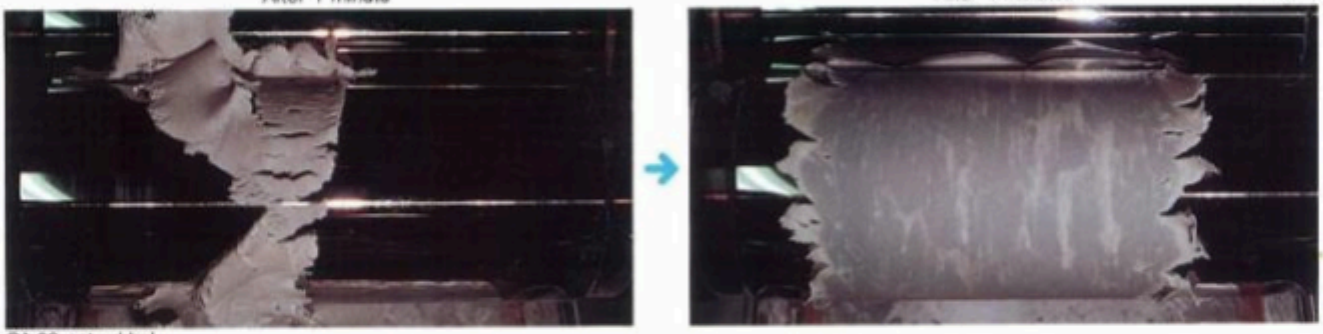


Results:

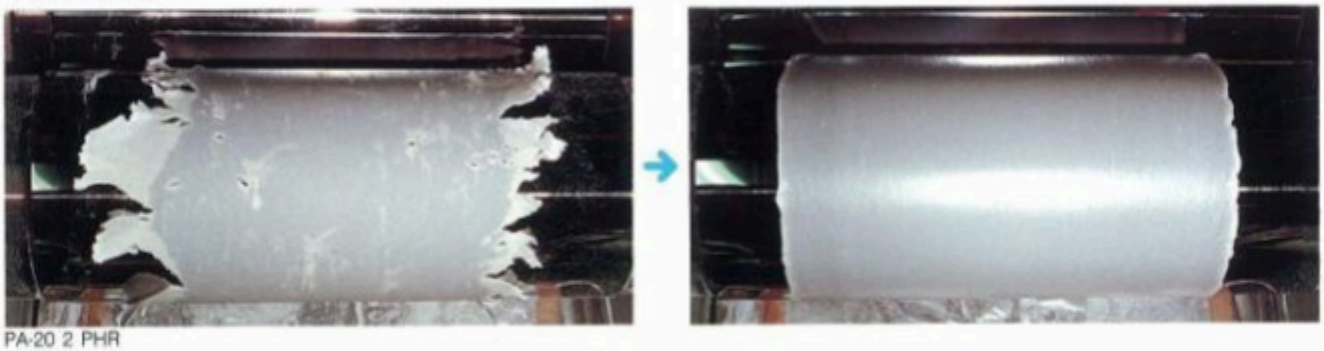
As shown in Photos 5 and 6, the increased gelation by KANE ACE PA-20 quickened takeup by the rolls and helped produce good sheets. Edge tear was sharply reduced so that effective sheet width was increased. These improvements were also notable where the filler was used as shown in Photo 6, indicating that a filler can be easily used in a high PA-20 PHR range.

Filler used

After 1 minute | After 4 minutes | Photo 6



PA-20 not added



PA-20 2 PHR

3 T-Die Inflation Forming

KANE ACE PA-20 is also effective as described below if 0.5 to 5 PHR of PA-20 is added in producing films, sheets and plates by the inflation process using various kinds of T-dies.

- Processing troubles, such as flow marks, particularly on thin products, and surging of thick ones, can be reduced so that formed products will have an improved appearance and better long-run performance can be expected.
- Better uniformity of gelation improves "neck-in" in forming.
- Stretchability is improved by increased elongation at high temperature.
- Secondary processability as in vacuum forming and bending will sharply increase.

KANE ACE PA-20 can be used in processing transparent products with hardly affecting their transparency. (Photo 3)

III. Moldability Characteristics of KANE ACE PA-20 Compounds

4 Profile Extrusion

PVC profile moldings of hard, foam, and soft types have rapidly extended the range of their applications from furniture, automobile parts, home electric appliance parts, and decorative parts to window sashes, sidings, and other architectural parts.

KANE ACE PA-20 is generally added to hard, semi-hard, and soft compounds by 0.5 to 5 PHR and compounds for expansion forming by 7 to 15 PHR in PVC profile molding with mainly the following effects.

- Smooth product surface.
- Easy molding of complex shapes.
- Steady long-run molding by the surging prevention effect.
- Improved melt viscosity and elasticity and the die swell effect prevent draw-down and improves sizing.
- Forming stability, finer cells, and uniform cell distribution in expansion forming.
- Improved secondary processability as in bending based on the improved gelation effect and better elongation.

In addition, KANE ACE PA-20 also helps improve heat resistance and weatherability as shown in Table 2 and Photo 2. The effects of KANE ACE PA-20 on soft moldings and foam products are shown in the following example.

Example 1

Soft Molding (Mole parts)

Table 9

Recipe:

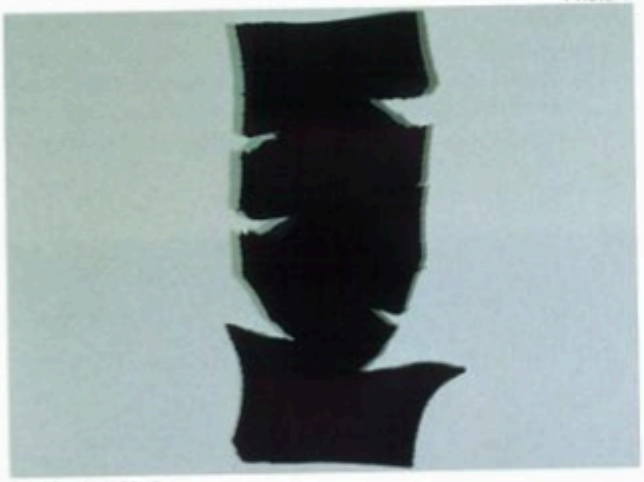
PVC	:	100 PHR
Lead stabilizer	:	5.0 PHR
Filler	:	30 PHR
Plasticizer	:	80 PHR
Pigment	:	As appropriate
KANE ACE PA-20	:	Variable (0/2)

Compounds:
Powder compounds prepared by using a ribbon blender

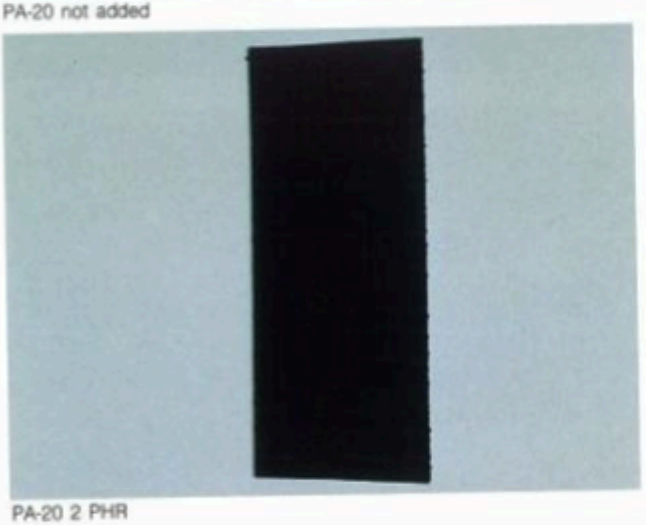
Molding machine: 30 mm in diameter, L/D = 20, C.R. = 3.0

Results:
Surface quality was sharply improved as shown in Photo 7 (which shows edge tears in this case).

Photo 7



PA-20 not added



PA-20 2 PHR

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Example 2

Hard Expansion Molding (Furniture parts)

Table 10

Recipe:

Kanevinyl S-1008 (*kv = 59-61)	:	100 PHR
Lead stabilizer	:	3.5 PHR
Lubricant	:	0.4 PHR
Foaming agent	:	0.4 PHR
Impact modifier (KANE ACE B-56)	:	7.0 PHR
KANE ACE PA-20	:	Variable (0/10)

(*kv: 1% cyclohexanone)

Compounds:

Compounds were blended by a super mixer (at 120°C) and processed into pellets by a 50 mm extruding machine.

Molding machine:

50 mm in diameter, L/D = 24, C.R. = 2.6
C_1 = 150 to 155°C
C_2 = 175 to 180°C
C_3 = 170°C
D = 170 to 175°C

Speed: 13 to 15 r.p.m.

Results:

As shown in Photos 8 and 9, KANE ACE PA-20 showed distinctive effects on surface quality and foam cell uniformity.

Photo 8

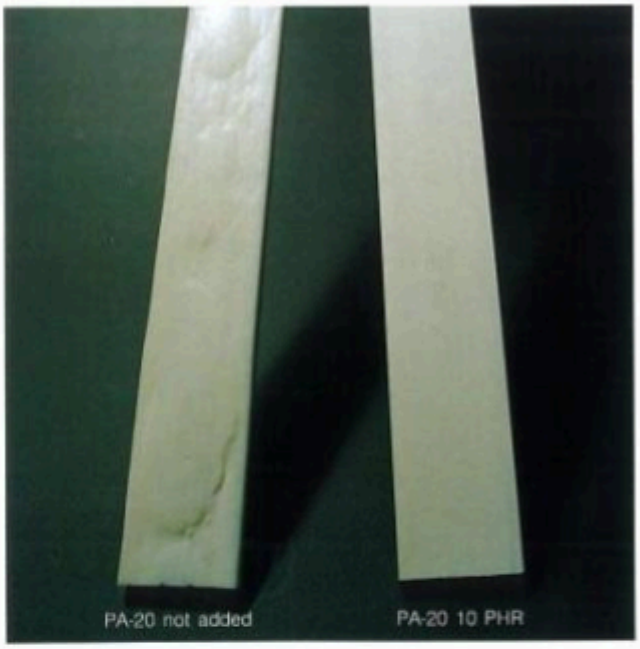
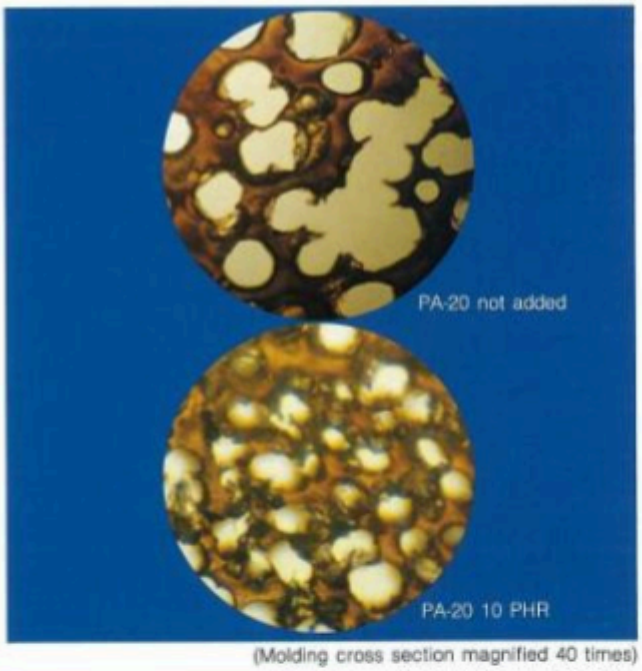


Photo 9



(Molding cross section magnified 40 times)

5 Blow Molding

Processability modifiers, typical of which is KANE ACE PA-20, are added to most of the compounds used in making bottles and other PVC products by blow molding as an indispensable additive.

The main effects of KANE ACE PA-20 are as follows:

- Improved melt viscosity and elasticity and the die swell effect prevent parison draw-down and help produce satisfactory moldings with little unevenness in wall thickness.
- Prevention of surging sharply improves the appearance of moldings and also long-run molding.

The stretchability improving effect of KANE ACE PA-20 can also improve processability in molding large-sized products by secondary blow molding.

The above effects can be well expected by adding KANE ACE PA-20 to dry blend compounds by 0.5 to 1.5 PHR and to pellet compounds by 1 to 2.5 PHR.

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6 Secondary Molding

Secondary ,forming in vacuum forming, pressure forming, bending, embossing, and various other types are often required in making PVC products. As shown in Table 1, KANE ACE PA-20 increases stretchability which sharply improves secondary processability and thus permits deep drawing. As a way of illustrating the effectiveness of KANE ACE PA-20 in secondary molding, the results of deep drawing calendered sheets by vacuum forming are shown below.

Example

Table 11

Recipe:

Kanevinyl S-1008 (*kv = 59-61)	:	100 PHR
Octyl tin mercaptide	:	1.5 PHR
Octyl tin maleate	:	0.5 PHR
Partially saponified montanic acid ester	:	0.2 PHR
Stearic acid	:	0.5 PHR
Monoglyceride stearate	:	1.5 PHR
Impact modifier (KANE ACE B-31)	:	8.0 PHR
KANE ACE PA-20	:	Variable (0/2/5)

(*kv: 1% cyclohexanone)

Compounds:

Powder compounds prepared by using a super mixer (at 120°C)

Calendering sheets:

After kneading by Banbury mixing rolls, the compounds were formed into sheets 0.2 mm thick by an 8-inch inverted L calender (R_1 to R_4 = 180°C to 185°C).

Vacuum forming:

The above sheets (0.2 mm thick) were heated by a hot-wire heater for 40 seconds, and then put to vacuum forming.

Results:

As shown in Photo 10, the sheet containing no KANE ACE PA-20 was torn in the forming process, whereas the sheets made of the compound containing KANE ACE PA-20 would be deep-drawn.

Photo 10

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7 Other Molding

• Pipe molding and sheath extrusion molding

As already described in the paragraphs (III-3, III-4, III-5) for various types of extrusion molding processes, KANE ACE PA-20 is also effective for improving the external appearance of pipe moldings, soft and semi-hard kinds and wire sheaths, their long-run production, and stabilizing their physical properties by adding KANE ACE PA-20 by about 0.5 to 3 PHR.

• Other resins

KANE ACE PA-20 was developed mainly for improving the moldability of PVC, but is found also effective for other resins.

For example:

Chlorinated polyvinylchloride (CPVC)

CPVC is used for producing pipes, joints and sheets because of its physical and chemical properties, but is one of the resins that are difficult to mold.

KANE ACE PA-20 is also effective for promoting gelation of CPVC, and thus improves the external appearance of CPVC products and CPVC processability as in the case of PVC.

ABS-PVC, CPE-PVC

KANE ACE PA-20 is also effective for compounds composed mainly of ABS or CPE in improving the uniformity of kneading and gelation and thus helps produce high quality moldings.

Safe Handling

Always exercise utmost care in handling materials because careless handling can be hazardous.

KANA ACE PA-20 products are inflammable and can trigger dust explosions under certain conditions.

In case of using any of these products under hazardous conditions, ask KANEKA for advice on proper handling, such as regards transportation by a pneumatic transfer system and storage in large hoppers.

The basic rules to be observed are clean housekeeping and safe handling.

Food Regulations

In marketing any food products using KANE ACE PA-20, all the regulations applicable to such products in the countries where the products are to be sold must be observed. KANEKA will assume no responsibility whatsoever for any consequences arising from failure to observe the regulations.

If you need further information on safe handling or food regulations, please contact KANEKA.

Important Notice

All technical statements, information and recommendations in this catalogue are based on tests and data which are believed to be reliable. Due to possible variations of conditions and processing methods beyond our control, no guarantees or warranties are expressed or implied as to the use, handling or processing of the materials involved. Nor do we guarantee product marketability or suitability to specific purposes. No suggestions are made in the catalogue whatsoever for infringement of any patents.

We expressly disclaim liabilities for any damage resulting from the use, handling or processing of KANE ACE PA-20, and for the results arising therefrom regardless of whether or not the material has been used, or is alleged to have been used, in accordance with the instructions given in the catalogue.