

STABILIZER FOR CHLORINE-CONTAINING POLYMERS AND
CHLORINE-CONTAINING POLYMER COMPOSITION

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

The present invention relates to a non-lead type stabilizer for chlorine-containing polymers and to a stabilized chlorine-containing polymer composition. More specifically, the invention relates to a stabilizer for
10 chlorine-containing polymers featuring markedly improved resistance against the aging at low temperatures, to a chlorine-containing polymer composition, and to a stabilizer that exhibits improved action for thermally stabilizing the chlorine-containing polymers.

15 2. Description of the Prior Art

Calcium silicate has long been used as a blending agent for the resins. Japanese Laid-Open Patent Publication No. 15237/1992 discloses that a fine crystalline calcium silicate having a particular X-ray
20 diffraction image serves as a blending agent for the resins exhibiting excellent thermally stabilizing action.

It has also been known that an isocyanurate compound can be contained in a chlorine-containing polymer. Japanese Laid-Open Patent Publication No. 74043/1976
25 discloses a vinyl chloride resin composition containing a tris(2-hydroxyethyl) isocyanate and an organic acid salt.

Moreover, it has long been known that a hydrotalcite exhibits action for thermally stabilizing the chlorine-containing polymer. For example, Japanese Laid-Open
30 Patent Publication No. 80445/1980 discloses blending a hydrotalcite in an amount of from 0.01 to 5 parts by weight per 100 parts by weight of a chlorine-containing polymer or the like.

It has been known already to use a silicate and a
35 hydrotalcite in combination as a stabilizer for the

chlorine-containing polymers. Japanese Laid-Open Patent Publication No. 179090/1993 discloses a stabilized resin composition containing from 0.05 to 10 parts by weight of a perchloric acid group-containing hydrotalcite and from
5 0.001 to 3 parts by weight of a silicate of aluminum or of an alkaline earth metal per 100 parts by weight of the chlorine-containing polymer.

Moreover, Japanese Laid-Open Patent Publication No. 109297/1996 discloses a vinyl chloride resin composition
10 for covering electric wires, containing from 0.05 to 10 parts by weight of the hydrotalcite per 100 parts by weight of a vinyl chloride resin, and from 0.001 to 3 parts by weight of a silicate of an alkaline earth metal having a molar ratio of silica of from 2.2 to 8 per the
15 oxide of an alkaline earth metal.

The above-mentioned stabilizers are worth evaluating from such a point of view that they exhibit thermally stabilizing action to some extent despite they are of the non-lead type, but are not still satisfactory in regard to
20 their resistance against the aging at low temperatures. Besides, there is still room for improvement from the standpoint of achieving high thermally stabilizing action by the blending in small amounts.

Problems inherent in the conventional chlorine-
25 containing polymers include heat resistance at relatively high temperatures of about 180°C. The heat resistance at high temperatures is of a great concern as a matter of course. However, the chlorine-containing polymers further involve a problem in that they are aged even when they are
30 exposed to relatively low temperatures of, for example, about 100°C for extended periods of time. Due to the aging at low temperatures, the resin tends to be colored or loses mechanical properties such as elongation.

SUMMARY OF THE INVENTION

35 The present inventors have discovered the fact that

the heat stability is markedly improved, resistance against the aging is markedly improved at low temperatures and the initial coloring does not occur when a fine crystalline calcium silicate having a particular

5 composition and a particular X-ray diffraction image is selected out of calcium silicates, or when a composite of this fine crystalline calcium silicate and a polyhydric alcohol is selected, and is combined with an isocyanurate compound.

10 That is, the object of the present invention is to provide a non-lead type stabilizer for chlorine-containing polymers that exhibits markedly improved heat stability and resistance against the aging at low temperatures.

The present inventors have further discovered the
15 fact that the heat stability is strikingly improved when a fine crystalline calcium silicate having a particular composition and a particular X-ray diffraction image is selected out of the calcium silicates and when it is combined with a hydrotalcite or salt of an alkali-aluminum
20 composite hydroxide.

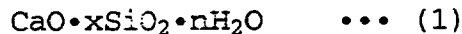
The present inventors have further discovered the fact that the heat stability is more improved when a composite comprising the fine crystalline calcium silicate and a polyhydric alcohol is formed, and is combined with
25 the hydrotalcite or with the salt of an alkali-aluminum composite hydroxide.

That is, the object of the present invention is to provide a stabilizer for chlorine-containing polymers having a strikingly improved heat stability.

30 Another object of the present invention is to provide a chlorine-containing polymer composition of the non-lead type which has excellent heat stability, excellent resistance against the aging at low temperatures and excellent electric insulating property, and is useful as a
35 covering material for electric wires.

According to the present invention, there is provided a stabilizer for chlorine-containing polymers comprising (A) a fine crystalline calcium silicate having a chemical composition expressed by the following general formula

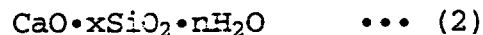
5 (1 ,



wherein x is a number of not smaller than 0.5, and n
 10 is a number of not larger than 2.5,
 and having an X-ray diffraction image in the spacing of from 3.01 to 3.08 angstroms, in the spacing of from 2.78 to 2.82 angstroms and in the spacing of from 1.81 to 1.84 angstroms, and (B) an isocyanurate compound, the fine
 15 crystalline calcium silicate (A) and the isocyanurate compound (B) being contained at a weight ratio of from 5:95 to 99.8:0.2.

According to the present invention, furthermore, there is provided a stabilizer for chlorine-containing
 20 polymers comprising (A) the fine crystalline calcium silicate, (B) the isocyanurate compound, and (C) a hydrotalcite or an alkali-aluminum composite salt, the component (B) being made present at a weight ratio of from 0.5 to 50 parts by weight per 100 parts by weight of the
 25 sum of (A) and (C).

According to the present invention, furthermore, there is provided a stabilizer for chlorine-containing polymers comprising (D) a fine crystalline calcium silicate having a chemical composition expressed by the
 30 following formula (2),



wherein x is a number of from 0.5 to 2.0, and n is a
 35 number of not larger than 2.5,

and having an X-ray diffraction image in the spacing of from 3.01 to 3.08 angstroms, in the spacing of from 2.78 to 2.82 angstroms and in the spacing of from 1.81 to 1.84 angstroms, and (C) a hydrotalcite or a salt of an alkali-aluminum composite hydroxide salt, at a weight ratio of from 0.5:99.5 to 99:1.

Moreover, the present invention provides a stabilizer for chlorine-containing polymers wherein the fine crystalline calcium silicate (A) (or (D)) is a composite (E) containing the fine crystalline calcium silicate (A) (or (D)) and a polyhydric alcohol at a weight ratio of from 20:80 to 80:20.

It is desired that the stabilizer of the present invention further contains:

1. (F) from 5 to 70 parts by weight of a higher fatty acid zinc per 100 parts by weight of the sum of the fine crystalline calcium silicate (A) (or (D) or (E)), and the hydrotalcite or the salt of an alkali-aluminum composite hydroxide salt (C);
2. (G) from 1 to 50 parts by weight of a phenol-type antioxidizing agent per 100 parts by weight of the sum of the fine crystalline calcium silicate (A) (or (D) or (E)) and the hydrotalcite or the salt of an alkali-aluminum composite hydroxide salt (C); or
3. (H) from 0.5 to 30 parts by weight of a β -diketone or a β -keto-acid ester per 100 parts by weight of the sum of the fine crystalline calcium silicate (A) (or (D) or (E)) and the hydrotalcite or the salt of an alkali-aluminum composite hydroxide salt (C).

It is desired that the chlorine-containing polymer composition of the present invention further contains:

1. from 0.2 to 10 parts by weight the fine crystalline calcium silicate (A) (or (D) or (E)) from 0.01 to 3 parts by weight and, particularly, from 0.02 to 1 part by weight of the isocyanurate compound (B), and/or from 0.1 to 10

- parts by weight of the hydrotalcite or the salt of an alkali-aluminum composite hydroxide salt (C);
2. from 0.1 to 5.0 parts by weight the higher fatty acid zinc (F);
- 5 3. from 0.01 to 5.0 parts by weight the phenol-type antioxidizing agent (G); or
4. from 0.01 to 5.0 parts by weight the β -diketone or the β -keto-acid ester (H).

BRIEF DESCRIPTION OF THE DRAWINGS

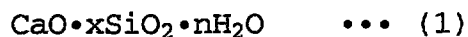
- 10 Fig. 1 is an X-ray diffraction image of a fine crystalline calcium silicate (CSH-1) according to a Synthesis Example 1;

Fig. 2 is an X-ray diffraction image of xonotlite; and

- 15 Fig. 3 illustrates how to find θ_1 and θ_2 for calculating an index (Is) of lamination asymmetry.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

- According to the present invention, there is selected, as a calcium silicate, a fine crystalline
- 20 calcium silicate having a chemical composition expressed by the following general formula (1),



- 25 wherein x is a number of not smaller than 0.5 and, preferably, from 0.5 to 5.0, and n is a number of not larger than 2.5,
- and having an X-ray diffraction image in the spacing of from 3.01 to 3.08 angstroms, in the spacing of from 2.78
- 30 to 2.82 angstroms and in the spacing of from 1.81 to 1.84 angstroms.

- The fine crystalline calcium silicate has been known as disclosed in the above-mentioned Japanese Laid-Open Patent Publication No. 15237/1992. According to the
- 35 present invention, the fine crystalline calcium silicate

is selected and is used in combination with an isocyanurate compound to obtain remarkably improved heat stability and resistance against the aging at low temperatures as demonstrated by Examples that will appear
5 later.

As the calcium silicate, there have been known many minerals such as xonotlite, tobermorite, etc. According to the present invention, however, a fine crystalline calcium silicate having the above-mentioned particular
10 chemical composition and the X-ray diffraction image is used as a main stabilizer to improve the heat stability of the chlorine-containing polymer.

It was learned that the fine crystalline calcium silicate used in the present invention works to markedly
15 improve the heat stability of the chlorine-containing polymer but still leaves room for improvement from the standpoint of resistance against the aging at low temperatures.

That is, when a chlorine-containing polymer
20 composition blended with the above-mentioned fine crystalline calcium silicate as the main stabilizer, is maintained at a temperature of 100°C for a week, the resin composition tends to be colored in pink.

However, when the chlorine-containing polymer
25 composition is blended with the fine crystalline calcium silicate and the isocyanurate compound at a weight ratio of from 5.0:95 to 99.8:0.2 and, particularly, at a weight ratio of from 15:85 to 99:1, the resin composition is not colored even after it is maintained at the above-mentioned
30 temperature for the above-mentioned period of time.

What can be compared with the aging at low temperatures of the chlorine-containing polymer are the initial coloring and general heat resistance of the chlorine-containing polymer. The initial coloring is that
35 of after the chlorine-containing polymer blended with the

stabilizer is heat-treated at a working temperature (generally, from 150 to 170°C), and the heat resistance is the evaluation of color under a temperature condition (generally, from 180 to 200°C) in which the hydrochloric acid-removing reaction of the chlorine-containing polymer takes place. On the other hand, the aging at low temperatures is the coloring or deterioration that occurs at considerably lower temperatures after the thermal hysteresis for extended periods of time, and it is considered that the temperature conditions and the causes are quite different.

According to the present invention, an improvement in the resistance against the aging at low temperatures was discovered as a phenomenon through experiment by combining the fine crystalline calcium silicate with an isocyanurate compound at a predetermined ratio. Though the reason does not at all restrict the present invention, it is considered that pink coloring is due to the formation of a polyene structure of a slight degree or due to the formation of a complex stemming from the mutual action between the fine crystalline calcium silicate and the chlorine-containing polymer, while it is believed that the isocyanurate compound is suppressing the formation of the polyene structure or the formation of a complex.

In the present invention, it is desired that the fine crystalline calcium silicate (A) (or a composite (E) thereof with a polyhydric alcohol) and the isocyanurate compound (B), are so combined together that the amount of the component (B) is from 0.5 to 50 parts by weight per 100 parts by weight of the sum of the component (A) (or the component (E)) and the hydrotalcite or the alkali-aluminum composite (C), from the standpoint of further improving the heat resistance while maintaining the resistance against the aging at an excellent level at low temperatures. As will be demonstrated by Comparative

Example 3 appearing later, furthermore, a vinyl chloride resin composition using the xonotlite as a main stabilizer exhibits a blackening time of about 120 minutes at 190°C and a hydrogen chloride-trapping time of 300 minutes as found by the Congo Red method. Whereas, the vinyl chloride resin composition (Example 1) blended with the fine crystalline calcium silicate defined by the present invention as a main stabilizer, exhibits a blackening time of not shorter than about 160 minutes at 190°C and a hydrogen chloride-trapping time of 362 minutes as found by the Congo Red method, proving an excellent thermal stabilizing action.

According to the present invention, furthermore, the fine crystalline calcium silicate is selected and is used in combination with the hydrotalcite or the like to markedly improve the heat stability as demonstrated by Examples of Table 7 etc. appearing later. That is, a composition (Comparative Example 9) which is blended with 2 parts by weight of the hydrotalcite together with other stabilizing assistant per 100 parts by weight of the vinyl chloride resin exhibits a blackening time (time until it is colored in black) of about 100 minutes at 190°C and a hydrogen chloride-trapping time of 264 minutes as found by the Congo Red method as shown in Table 8 appearing later. When the xonotlite-type calcium silicate is added in an amount of 0.5 parts by weight to the above-mentioned stabilizing agent (Comparative Example 10), there are exhibited the blackening time of about 100 minutes and a hydrogen chloride-trapping time of 265 minutes like when no calcium silicate is blended. On the other hand, when the fine crystalline calcium silicate is added in an amount of 0.5 parts by weight (Example 19) like in the above-mentioned case, the blackening time is extended to about 160 minutes and the hydrogen chloride-trapping time is extended to 312 minutes, proving the meaning of

selecting the fine crystalline calcium silicate according to the present invention.

The meaning for combining the fine crystalline calcium silicate with the hydrotalcite of the present invention will become obvious from Table 9, too, that will appear later. That is, when the fine crystalline calcium silicate is used in an amount of 0.5 parts by weight in combination with other stabilizer assistant (Comparative Example 13), the blackening occurs after heated at 190°C for 10 minutes due, probably, to zinc burning and the hydrogen chloride-trapping time is as short as 11 minutes. When the fine crystalline calcium silicate in an amount of 0.5 parts by weight is used in combination with 3 parts by weight of the hydrotalcite (Example 23), however, the blackening does not occur even after heated at 190°C for 180 minutes and the hydrogen chloride-trapping time is astonishingly extended to be 493 minutes. Compared with when no hydrotalcite is blended, furthermore, the electric insulation is improved by more than ten times as considered from the volume resistivity, from which it will be understood that the chlorine-containing polymer composition containing the stabilizer of the present invention is useful as a covering material for electric wires.

According to the present invention, the fine crystalline calcium silicate and the polyhydric alcohol are used in the form of a composite, for example, obtained by the wet-type co-pulverization to synergistically improve the heat stability compared with when they are used as a simple mixture. As shown in, for example, Table 10, when the vinyl chloride resin is simply blended with the fine crystalline calcium silicate, the polyhydric alcohol and the hydrotalcite (Example 28), the resin composition exhibits a blackening time of about 120 minutes and a hydrogen chloride-trapping time of 158

minutes. When the fine crystalline calcium silicate and the polyhydric alcohol are used in the form of a composite (Example 26), however, the resin composition exhibits a blacking time that is extended to about 140 minutes and a
5 hydrogen chloride-trapping time that is extended to 192 minutes despite the ratio of amounts is the same.

[Fine Crystalline Calcium Silicate]

The fine crystalline calcium silicate used in the present invention has a chemical composition as expressed
10 by the above-mentioned general formula (1) and the above-mentioned X-ray diffraction image. In the general formula, x is a number of not smaller than 0.5, and n is a number of not larger than 2.5 but which is desirably from 0.5 to 1.0.

15 When the content of silica is greater than this range, the heat stability tends to be deteriorated compared with when the content of silica lies within this range. When the content of silica is smaller than this range, on the other hand, the initial coloring tends to
20 increase compared with when the content of silica lies within this range. The fine crystalline calcium silicate that is slightly hydrated tends to exhibit increased activity for heat stabilization. When the amount of hydration is too great, however, the resin tends to be
25 foamed, which is not desirable.

Fig. 1 shows an X-ray diffraction image of the fine crystalline calcium silicate used in the present invention, and Fig. 2 shows an X-ray diffraction image of the xonotlite having a chemical composition close to the
30 fine crystalline calcium silicate. From this comparison, it will be understood that the calcium silicate used in the present invention is finely crystalline.

The X-ray diffraction image of the fine crystalline calcium silicate used in the present invention includes
35 three strong lines as shown in the following Table 1,

Table 1

	<u>2 θ</u>	<u>Spacing ($\text{\AA}$)</u>	<u>Relative intensity</u>
5	29.2	3.01 - 3.08	m
	32.0	2.78 - 2.82	w
	49.3	1.81 - 1.84	w

wherein m stands for intermediately strong, and w
10 stands for weak.

It will be understood from Fig. 1 that the most
intense peak is considerably broad.

In the X-ray diffraction of the crystals, it has been
known that an intensity peak appears in the interference
15 when the following Bragg's formula (4),

$$n\lambda = 2d_{hkl} \sin \theta \quad \dots (4)$$

wherein n is a degree, λ is a wavelength of X-ray,
20 d_{hkl} is a spacing of crystals (hkl), and θ is an
angle of diffraction,
is satisfied. Between the sharpness of the interference
peak and the size of the crystals, there exists a
relationship expressed by the following Scherrer's formula
25 (5),

$$L_{hkl} = K\lambda / (H \cos \theta) \quad \dots (5)$$

wherein L_{hkl} is a size of the crystal in a direction
30 perpendicular to the plane (hkl), K is a constant of
about 0.9, H is a half width (radian) of an
interference peak, and λ and θ are as defined in
the above formula (4).

When a half width of the diffraction peak of an index
35 of a plane (040) (spacing of 3.01 to 3.08 angstroms) is

found from the X-ray diffraction image of Fig. 1 and the size of a crystallite is calculated from the half width in compliance with the above-mentioned formula (4), the size of the crystallite of the index of the plane (040) is
5 suppressed to lie generally from 60 to 120 Å.

The action of calcium silicate for heat stabilization is expressed through the surface of the crystal. The surface area increases with a decrease in the size of the crystallite, as a matter of course. It will therefore be
10 easily understood that the fine crystalline calcium silicate used in the present invention exhibits excellent heat stabilizing action.

It is desired that the fine crystalline calcium silicate has an index of lamination asymmetry (I_s) as
15 defined by the following formula (3),

$$I_s = \tan \theta_2 / \tan \theta_1 \quad \dots (3)$$

wherein θ_1 is an angle subtended by a peak
20 perpendicular in an X-ray diffraction peak of a spacing of 3.01 to 3.08 angstroms and a tangent of the side of a narrow angle, and θ_2 is an angle subtended by a peak perpendicular in the above-mentioned peak and a tangent of the side of a broad
25 angle,

of not smaller than 1.75 and, particularly, from 1.8 to 2.0. As will be obvious from the above-mentioned X-ray diffraction image, the fine crystalline calcium silicate used in the present invention is in a laminar fine
30 crystalline form, and the above-mentioned index of lamination asymmetry represents the degree of irregularity of the lamination of layer in the direction of C-axis. The greater the index of lamination asymmetry, the greater the irregularity. The fine crystalline calcium silicate
35 used in the present invention is irregularly laminated

and, hence, has a large active surface and exhibits excellent action for stabilizing the chlorine-containing polymer.

It is desired that the fine crystalline calcium
5 silicate used in the present invention usually has such a particle size distribution that those having a particle size of not smaller than 40 μm are contained in an amount of not larger than 10% by weight of the whole amount and those having a particle size of not larger than 20 μm are
10 contained in an amount of not smaller than 50% by weight of the whole amount, from the standpoint of being uniformly dispersed in the chlorine-containing polymer and exhibiting thermally stabilizing effect. Being related to the structure of the particles, furthermore, the fine
15 crystalline calcium silicate has a relatively large specific area of from 60 to 200 m^2/g and, particularly, from 70 to 150 m^2/g , a porous volume of not smaller than 0.5 ml/g and, particularly, from 1.0 to 4.0 ml/g , and an oil-absorbing amount of from 50 to 250 $\text{ml}/100 \text{ g}$ and,
20 particularly, from 80 to 200 $\text{ml}/100 \text{ g}$.

The fine crystalline calcium silicate is produced by finely pulverizing amorphous activated silicic acid in the milk of lime, to which only, however, the production is in no way limited.

25 It is desired that a salt with silicic acid of a metal of the Group II of periodic table used in the present invention has, in the pores or on the surfaces thereof, an organic blending agent that exhibits a masking action or a chelating action for zinc chloride.

30 Desirably, the organic blending agent used for this purpose will be a polyhydric alcohol, phenols, β -keto-acid ester or β -diketone. Suitable examples are as described below.

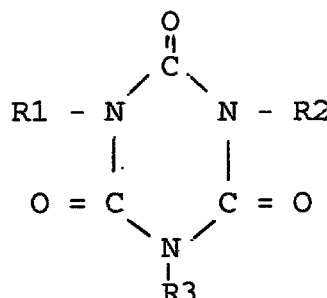
That is, examples of the polyhydric alcohol include
35 ethylene glycol, diethylene glycol, triethylene glycol,

polyethylene glycol, trimethylene glycol, tetramethylene glycol, hexamethylene glycol, neopentyl glycol, glycerin, diglycerin, pentaerythritol, dipentaerythritol, mannitol, sorbitol, trimethylolpropane, ditrimethylolpropane,
 5 isocyanurate derivative, dipentaerythritol adipate, etc.
 [Isocyanurate Compound]

It is desired that the isocyanurate compound used in the present invention is a tris(hydroxyalkyl) cyanurate expressed by the following formula (6),

10

15



wherein R1, R2 and R3 are hydroxyalkyl groups.

20

Its preferred examples include tris(hydroxyethyl) cyanurate, tris(hydroxypropyl) cyanurate, tris(hydroxybutyl) cyanurate, tris(2,3-dihydroxypropyl) cyanurate, tris(glycidyl) cyanurate, etc.

It is important that the tris(hydroxyalkyl) cyanurate
 25 is used at the above-mentioned ratio. When its amount is smaller than the above-mentioned ratio, the resistance against the aging at low temperatures tend to decrease compared with when its amount lies within the range of the present invention. When its amount is larger than the
 30 above-mentioned ratio, the heat resistance tends to decrease compared with when its amount lies within the range of the present invention.

Examples of the phenol-type antioxidizing agent include bisphenol A, bisphenol B, bisphenol F, 2,6-
 35 diphenyl-4-octadecyloxyphenol, stearyl (3,5-di-tert-butyl-

4-hydroxyphenyl) propionate, distearyl (3,5-di-tert-butyl-4-hydroxybenzyl) phosphonate, 1,6-hexamethylenebis(3,5-di-tert-butyl-4-hydroxyphenyl) propionate, 1,6-hexamethylenebis(3,5-di-tert-butyl-4-hydroxyphenyl)amide
 5 propionate, bis[3,3-bis(4-hydroxy-3-tert-butylphenyl) butyric acid]glycol ester, 1,1,3-tris(2-methyl-4-hydroxy-5-tert-butylphenyl) butane, 1,3,5-tris(2,6-dimethyl-3-hydroxy-4-tert butylbenzyl) isocyanurate, 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl) isocyanurate, triethylene
 10 glycolbis[(3-tert-butyl-4-hydroxy-5-methylphenyl) propionate], etc.

Examples of the β -diketone or β -keto-acid ester include 1,3-cyclohexadione, methylenebis-1,3-cyclohexadione, 2-benzyl-1,3-cyclohexadione,
 15 acetyltetralone, palmitoyltetralone, stearoyltetralone, benzoyltetralone, 2-acetylcyclohexanone, 2-benzoylcyclohexanone, 2-acetyl-1,3-cyclohexanedione, bis(benzoyl) methane, benzoyl-p-chlorobenzoylmethane, bis(4-methylbenzoyl) methane, bis(2-hydroxybenzoyl)
 20 methane, benzoylacetone, tribenzoylmethane, diacetylbenzoylmethane, stearoylbenzoylmethane, palmitoylbenzoylmethane, lauroylbenzoylmethane, dibenzoylmethane, bis(4-chlorobenzoyl) methane, bis(methylene-3,4-dioxybenzoyl) methane,
 25 benzoylacetylphenylmethane, stearoyl(4-methoxybenzoyl) methane, butanoylacetone, distearoylmethane, acetylacetone, stearoylacetone, bis(cyclohexanoyl) methane, dipivaloylmethane, etc.

The above-mentioned organic blending agents are used
 30 in a single kind or in combination, and are, desirably, blended in an amount of from 1 to 250% by weight, particularly, from 10 to 200% by weight and, most desirably, from 100 to 200% by weight with respect to a salt with silicic acid of a metal of the Group II of
 35 periodic table.

In a preferred embodiment of the present invention, use is made of a composite (E) of the fine crystalline calcium silicate and the polyhydric alcohol at a weight ratio of 20:80 to 80:20 and, particularly, 30:70 to 60:40.

5 This composite markedly improves the heat stability of the chlorine-containing polymer, prevents the initial coloring or zinc burning, and exhibits a small migrating property. This composite is generally obtained by wet- or dry-pulverizing the polyhydric alcohol and the fine

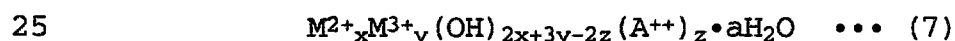
10 crystalline calcium silicate.

When the amount of the polyhydric alcohol becomes smaller than the above-mentioned range, initial coloring and zinc burning are not suppressed to a satisfactory degree. When the amount of the polyhydric alcohol exceeds

15 the above-mentioned range, the migrating property tends to increase. As the polyhydric alcohol, there can be preferably used a pentaerythritol or a dipentaerythritol. [Hydrotalcite]

The hydrotalcite used in combination with the fine

20 crystalline calcium silicate is a synthetic mineral that pertains to a carbonate of an aluminum-magnesium hydroxide. There is used a hydroxide of a composite metal having a general formula (7),

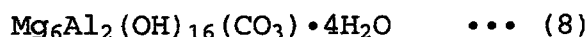


wherein M^{2+} is a divalent metal ion such as of Mg, M^{3+} is a trivalent metal ion such as of Al, A^{++} is a divalent anion such as CO_3 , and x, y and z are

30 positive integers satisfying $8 \geq x/y \geq 1/4$ and $z/x+y > 1/20$, and "a" is a number satisfying $0.25 \leq a/x+y \leq 1.0$.

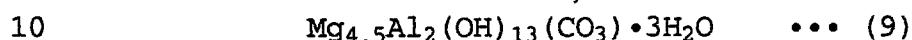
Among the hydroxides of these composite metals, a compound expressed by the formula (8),

35



is a natural mineral known as hydrotalcite. This mineral and homologs thereof can be synthesized by methods disclosed in Japanese Patent Publications Nos. 32198/1972, 29477/1973 and 29478/1973 filed by Kyowa Kagaku Kogyo Co.

It has been known that these hydrotalcites and, particularly, the compound represented by the formula (9),



exhibits excellent property for trapping chlorine ions and, hence, can be blended in the present invention.

The hydrotalcite into which perhalogenated oxygen acid ions are introduced can be used by utilizing the property that ions can be easily exchanged in a state where the hydrotalcites are sufficiently dispersed in the water, i.e., by utilizing such a property that the carbonic acid ions are exchanged with other anions.

In the present invention, the ordinary Mg-type hydrotalcite can be used as a matter of course and it is also allowable to use a hydrotalcite modified with zinc. As the hydrotalcite modified with zinc, there can be used the one represented by the above-mentioned general formula (7) in which the divalent metal ion of M^{2+} is a combination of Mg and Zn, and the atomic ratio of Mg:Zn is from 9:1 to 1.8:1 and, particularly, from 3:1 to 2.5:1, imparting excellent heat stability and preventing initial coloring.

[Salt of Alkali-Aluminum Composite Hydroxide]

As the carbonate of alkali-aluminum hydroxide used in the present invention, there can be exemplified a carbonate of lithium-aluminum hydroxide, a carbonate of the dawsonite-type sodium-aluminum hydroxide, or mixture crystals thereof.

(1. Carbonate of Lithium-Aluminum Hydroxide)

A carbonate of lithium-aluminum composite hydroxide (Lithium Aluminium Hydroxide Carbonate Salt: LAHCS) is presumed to be the one in which lithium ions have entered
5 into vacant positions of an octahedral layer of aluminum hydroxide of the gibbsite structure, and anions are incorporated therein to compensate for an electric charge. That is, the lithium ion has the smallest radius among the cations, and is a six-coordinate ion which is exceptional
10 as a monovalent ion. It is therefore considered that the lithium ion enters into the above vacant position to establish the above-mentioned structure.

The carbonate of lithium-aluminum hydroxide used in the present invention has a composition expressed by the
15 following formula (10),



wherein X is an inorganic anion consisting chiefly of
20 a carbonic acid radical, M is an alkali metal consisting chiefly of lithium, m is a number of from 1.5 to 2.5, n is a number of from 0.1 to 1, and k is a number of from 0 to 10,
and has X-ray diffraction images shown in the following
25 Table 2.

30

35

Table 2

	<u>Spacing d(Å)</u>	<u>Peak intensity</u>	<u>Index of a plane</u>
5	7.50 to 7.64	large	(002)
	4.30 to 4.44	small	(110)
	3.70 to 3.84	large	(004)
	2.45 to 2.58	intermediate	(006)
	2.20 to 2.30	small	(016)
10	1.85 to 2.08	small	(017)
	1.40 to 1.52	small	(330)
	1.38 to 1.48	small	(600)

A preferred carbonate of the lithium-aluminum
 15 composite hydroxide has an index of lamination asymmetry
 (Is) as defined by the following formula (3),

$$Is = \tan \theta_2 / \tan \theta_1 \quad \dots (3)$$

20 wherein θ_1 is an angle subtended by a peak
 perpendicular in an X-ray diffraction peak of a
 predetermined spacing and a tangent of the side of a
 narrow angle, and θ_2 is an angle subtended by a peak
 perpendicular in the above-mentioned peak and a
 25 tangent of the side of a broad angle,
 of not larger than 1.0 in the peak of an index of a plane
 (016) and not larger than 1.0 in the peak of an index of a
 plane (017).

The carbonate of lithium-aluminum hydroxide used in
 30 the present invention has an infrared-ray absorption
 spectrum exhibiting large absorption at wave numbers of
 547, 735, 1004, 1375 and 3443 cm^{-1} .

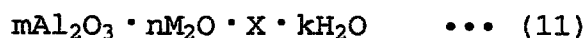
It is desired that the carbonate particles of the
 lithium-aluminum hydroxide used in the present invention
 35 have a volume-based median diameter (D_{50}) of, generally,

from 0.1 to 10 μm and, particularly, from 0.1 to 3 μm , a bulk density of from 0.1 to 0.35 g/cm^3 and, particularly, from 0.25 to 0.35 g/cm^3 as measured under JIS K 6721, has a BET specific surface area of from 10 to 70 m^2/g , and an
 5 oil-absorbing amount of as small as from 40 to 70 $\text{ml}/100$ g.

Though not necessarily limited thereto only, the carbonate of the lithium-aluminum hydroxide is prepared by a method in which an amorphous or a pseudo boehmite-type
 10 hydrated alumina gel is reacted with a carbonate or a bicarbonate of lithium in an aqueous medium under the conditions in which the concentration of alumina (Al_2O_3) becomes from 1 to 5% by weight, and the pH becomes from 7 to 11 at the time when the reaction has finished
 15 (hereinafter often referred to simply as hydrated alumina gel method), or by a method in which fine particles of the gibbsite-type aluminum hydroxide is reacted with a combination of a carbonate and a lithium compound capable of forming a lithium salt of carbonic acid or carbonic
 20 acid ions or lithium ions, in the presence of the water, i.e., by a migration method.

(2. Carbonate of Sodium-Aluminum Hydroxide)

A carbonate of the sodium-aluminum hydroxide (Na-Aluminum Hydroxide Carbonate Salt: NAHCS) of the dawsonite-type used in the present invention has a
 25 composition expressed by the following formula (11),



wherein X is an inorganic anion consisting chiefly of a carbonic acid ion, M is an alkali metal consisting
 30 chiefly of sodium, m is a number of from 0.5 to 1.5, n is a number of from 0.1 to 1, and k is a number of from 0 to 3.

The dawsonite-type crystalline structure refers to those having an X-ray diffraction image substantially the
 35 same as those shown in the following Table 3 in the X-ray

analysis by using Cu- α ,

Table 3

5	<u>Spacing (Å)</u>	<u>Relative intensity</u>	<u>Index of a plane</u>
	5.7	VS	(001)
	3.38	m	(020)
	3.02	m	(013)
10	2.78	S	(121)
	2.61	m	(004)
	2.5	w	(211)
	2.15	w	(220)
	1.99	m	(015)
15	1.73	w	(231)
	1.69	m	(125), (040)

wherein VS represents very strong, S represents strong, m represents intermediately strong, and w represents weak.

The dawsonite does not substantially lose the weight at temperatures of not higher than 300°C in the thermogravimetric analysis, and therefor it is useful for preventing the foaming at the time of kneading or molding the resin.

The carbonate of the sodium-aluminum composite hydroxide of the dawsonite-type crystalline structure has a half width of a peak of an index of a plane (011) of not smaller than 0.4 degrees in the Cu- α X-ray diffraction image, and exhibits a resistivity of not larger than 8000 $\Omega \cdot \text{cm}$ when it is formed into an aqueous slurry of a concentration of 5% by weight.

In the carbonate of the sodium aluminum hydroxide used in the present invention, a large half width of the peak of the index of a plane (011) means that the

crystalline size is small in the direction of b-axis (in the direction of axis of the fiber).

In the general dawsonite, bundles of fine fibers having a very large aspect ratio are entangled together to form coarse filamentary ball-like secondary particles. In the above-mentioned dawsonite, however, the fibrous structure is developed very poorly, and the secondary particles that are formed are coagulated to a small degree.

In connection with the form of the particles, the dawsonite, in general, exhibit an oil-absorbing amount of as relatively great as from 70 to 100 ml/100 g. However, the dawsonite preferably used in the present invention exhibits an oil-absorbing amount of not smaller than 40 ml/100 g but smaller than 70 ml/100 g. Moreover, the volume concentration of pigment in the former dawsonite is as small as 35% or less, whereas that of the latter dawsonite is as high as from 40 to 50%.

It is further desired that the carbonate particles of the sodium-aluminum hydroxide of the dawsonite-type of the present invention has a volume-based median diameter (D_{50}) of, generally, from 0.1 to 10 μm and, particularly, from 0.1 to 3 μm as measured by the laser scattered diffraction method, an oil-absorbing amount (JIS K-5101) of from 50 to 110 ml/100 g, a BET specific surface area of from 30 to 110 m^2/g , and an apparent specific weight (steel cylinder method) of from 0.1 to 0.3 g/cm^3 .

Though not necessarily limited thereto only, the carbonate of the sodium-aluminum hydroxide of the dawsonite-type is prepared by the above-mentioned hydrated alumina gel method by using a carbonate of sodium instead of a carbonate of lithium.

By using a sodium carbonate and a lithium carbonate in combination as an alkali salt to be reacted with the amorphous or pseudo boehmite type hydrated alumina, there

is obtained a carbonate of the alkali-aluminum composite hydroxide comprising mixed crystals of LAHCS and dawsonite.

The LAHCS and the dawsonite-type NAHCS can be
5 directly blended in the chlorine-containing polymer. In order to improve surface characteristics of the composite salt, the surface may be treated in advance with a surface treating agent in an amount of not larger than 10% by weight and, particularly, from 1 to 6% by weight, from the
10 standpoint of improving dispersion in the resin and improving light transmission property.

As the surface treating agent, there can be used a coupling agent of the type of silane, aluminum, titanium or zirconium, higher fatty acid, metal soap or resin acid
15 soap, fine powdery amorphous silica or surfactant depending upon the object.

In general, it is desired to add a higher fatty acid or a surfactant to a reaction mother solution containing a carbonate of alkali-aluminum composite hydroxide to
20 execute the treatment with stirring.

These hydrotalcites or the salts of alkali-aluminum composite hydroxide can be used in a single kind or in combination in an amount of from 0.5 to 50 parts by weight per 100 parts by weight of the sum of the above-mentioned
25 components (A) (or (D) or (E)) and (C).

[Higher Fatty Acid Zinc]

According to the present invention, it is desired to further blend, in addition to the above-mentioned essential components, (F) a higher fatty acid zinc in an
30 amount of from 5 to 70 parts by weight and, particularly, from 10 to 50 parts by weight per the sum of 100 parts by weight of the components (A) (or (D) or (E)) and (C). Addition of the above-mentioned component (F) makes it possible to effectively prevent the initial coloring of a
35 warm color.

The fatty acid for forming a zinc salt will be an unsaturated fatty acid having 8 to 22 carbon atoms, particularly, from 8 to 14 carbon atoms and, most desirably, from 8 to 12 carbon atoms, i.e., saturated fatty acid such as octylic acid, capric acid, undecanoic acid, lauroleic acid or myristic acid, or unsaturated fatty acid such as linderic acid, Tsuzuic acid, petroselinic acid, oleic acid, linoleic acid, linolenic acid, and arachidonic acid. It is also allowable to use stearic acid, palmitic acid or the like acid. From the standpoint of preventing the zinc burning, however, it is desired to use a lower fatty acid. From the standpoint of stability, it is desired to use a saturated fatty acid, and lauroleic acid is most desired. The fatty acid may be a mixture of fatty acids such as coconut oil and fatty acid, or palm oil and fatty acid.

These fatty acid salts also work as a lubricant and should, desirably, be normal salts.

[Phenol-Type Antioxidizing Agent]

In the present invention, furthermore, it is desired to use, in addition to the above-mentioned essential components, (G) a phenol-type antioxidantizing agent in an amount of from 1 to 50 parts by weight and, particularly, from 2 to 20 parts by weight per 100 parts by weight of the sum of the components (A) (or (D) or (E)) and (C). The antioxidantizing agent is effective in suppressing the degradation caused by the chain reaction.

As the phenol-type antioxidantizing agent used for the present invention, there can be used any one of those exemplified above, a bisphenol-type antioxidantizing agent or steric hindrance phenol-type antioxidantizing agent. Among them, the bisphenol A is particularly preferred.

These phenol-type antioxidantizing agents can be used alone or in combination.

[β -Keto-Acid Ester or β -Diketone]

According to the present invention, furthermore, there can be blended, in addition to the above-mentioned essential components, (H) a β -keto-acid ester or a β -diketone in an amount of from 0.5 to 30 parts by weight and, particularly, from 1 to 15 parts by weight per 100 parts by weight of the sum of the components (A), (D) or (E) and (C). The β -keto-acid ester or the β -diketone that is blended works to improve the heat stability and the tendency of initial coloring.

10 Examples of the β -keto-acid ester or the β -diketone that can be used were described above already and can be used in one kind or in a combination of two or more kinds. [Composite Stabilizer]

15 The composite stabilizing agent of the present invention can be used in the form of a powder or in the form of particles, as a one-pack stabilizing agent. The particles can be produced by a known granulating method such as extrusion-molded granulating method, spray granulating method, rotary disk granulating method, rolled granulating method or compression granulating method. The diameter of the particles can be arbitrarily adjusted depending upon the object. In general, it is desired, that the particle diameter is from 50 μm to 5 mm and, particularly, from 70 μm to 2 mm.

25 The composite stabilizing agent of the present invention can be blended with a known blending agent for resins, such as coloring material, inorganic or organic filler, antioxidizing agent, lubricating agent, plasticizer, chelating agent, antibacterial agent, photo-stabilizer, flame-retarding agent, shock-resisting agent, basic metal salt of inorganic acid, perchlorate, ultraviolet ray-absorbing agent, epoxy compound, antistatic agent and the like.

[Basic Metal Salt of Inorganic Acid]

35 A basic metal salt is a basic metal salt of an

inorganic acid. As a preferred metal component, there can be exemplified Li, Na, K, Mg, Ca, Sr, Ba, Zn, Ti, Al, Zr or Sn. As an inorganic acid, there can be exemplified phosphoric acid, phosphorous acid, silicic acid, nitric acid, nitrous acid, sulfuric acid, sulfurous acid, boric acid or carbonic acid.

Preferred examples of the salt of basic inorganic acid include $\text{Mg}(\text{OH})_2$, $\text{Ca}(\text{OH})_2$, $\text{Al}(\text{OH})_3$, $\text{Ba}(\text{OH})_3$, MgO , CaO , BaO , Al_2O_3 , SnO_2 , $3\text{CaO} \cdot \text{Na}_3\text{PO}_4$, $5\text{CaO} \cdot \text{NaHPO}_4$, $\text{MgO} \cdot \text{Mg}_3(\text{PO}_4)_2$, $3\text{CaO} \cdot \text{Ca}_3(\text{PO}_4)_2$, $\text{Ca}(\text{OH})_2 \cdot \text{Ca}_3(\text{PO}_4)_2$, $\text{Ba}(\text{OH})_2 \cdot \text{Ca}_3(\text{PO}_4)_2 \cdot 3\text{H}_2\text{O}$, $\text{Sr}(\text{OH})_2 \cdot \text{Sr}_3(\text{PO}_4)_2$, $\text{BaO} \cdot \text{Ba}_3(\text{PO}_4)_2$, $3\text{Ba}(\text{OH})_2 \cdot \text{Ba}_3(\text{PO}_4)_2$, $\text{ZnO} \cdot \text{Zn}_3(\text{PO}_4)_2$, $2\text{ZnO} \cdot \text{Ba}_3(\text{PO}_4)_2$, $\text{Al}_2\text{O}_3 \cdot \text{AlPO}_4$, $3\text{SnO} \cdot \text{Sn}_3(\text{PO}_4)_2$, $\text{Ba}(\text{OH})_2 \cdot \text{NaH}_2\text{PO}_4$, $5\text{CaO} \cdot \text{NaH}_2\text{PO}_4$, $3\text{Ba}(\text{OH})_2 \cdot \text{K}_2\text{HPO}_4$, $\text{MgO} \cdot \text{MgH}_2\text{PO}_4$, $5\text{Mg}(\text{OH})_2 \cdot \text{MgH}_2\text{PO}_4$, $\text{CaO} \cdot \text{CaH}_2\text{PO}_4$, $3\text{Ca}(\text{OH})_2 \cdot \text{CaH}_2\text{PO}_4$, $\text{Ba}(\text{OH})_2 \cdot \text{CaH}_2\text{PO}_4$, $5\text{CaO} \cdot \text{CaH}_2\text{PO}_4$, $\text{BaO} \cdot \text{BaH}_2\text{PO}_4$, $2\text{Ba}(\text{OH})_2 \cdot \text{BaH}_2\text{PO}_4$, $3\text{Ba}(\text{OH})_2 \cdot \text{BaH}_2\text{PO}_4 \cdot 3\text{H}_2\text{O}$, $\text{ZnO} \cdot \text{ZnH}_2\text{PO}_4$, $\text{ZnO} \cdot 3\text{CaH}_2\text{PO}_4$, $\text{TiO}_2 \cdot \text{Ti}(\text{H}_2\text{PO}_4)_2$, $\text{Al}_2\text{O}_3 \cdot \text{Al}_2(\text{H}_2\text{PO}_4)_3$, $3\text{ZrO} \cdot \text{ZrH}_2\text{PO}_4$, $\text{SnO} \cdot \text{SnH}_2\text{PO}_4$, $3\text{SnO} \cdot \text{SnH}_2\text{PO}_4$, $\text{Mg}(\text{OH})_2 \cdot \text{Mg}_2\text{SiO}_4$, $3\text{MgO} \cdot \text{MgSiO}_3$, $\text{CaO} \cdot \text{Ca}_2\text{SiO}_4$, $3\text{CaO} \cdot \text{Li}_2\text{SiO}_3$, $3\text{CaO} \cdot \text{CaSi}_2\text{O}_5$, $2\text{Ca}(\text{OH})_2 \cdot \text{Ca}_2\text{Si}_3\text{O}_8$, $\text{SrO} \cdot \text{SrSiO}_3$, $5\text{BaO} \cdot \text{Ba}_2\text{SiO}_4$, $\text{Ba}(\text{OH})_2 \cdot \text{Ba}_2\text{SiO}_4 \cdot 6\text{H}_2\text{O}$, $\text{Ba}(\text{OH})_2 \cdot \text{BaSiO}_3$, $3\text{Ba}(\text{OH})_2 \cdot \text{BaSi}_2\text{O}_5$, $3\text{BaO} \cdot \text{Ba}_2\text{SiO}_4$, $\text{Ba}(\text{OH})_2 \cdot \text{CaSiO}_3$, $2\text{ZnO} \cdot \text{ZnSiO}_3$, $\text{ZnO} \cdot 3\text{CaSiO}_3$, $\text{CaO} \cdot \text{Sn}_2\text{SiO}_4$, $\text{Mg}(\text{OH})_2 \cdot \text{Mg}(\text{NO}_3)_2$, $3\text{CaO} \cdot \text{Ca}(\text{NO}_3)_2$, $2\text{Ca}(\text{OH})_2 \cdot \text{Ca}(\text{NO}_3)_2 \cdot 5\text{H}_2\text{O}$, $3\text{BaO} \cdot \text{Ba}(\text{NO}_3)_2$, $\text{Ba}(\text{OH})_2 \cdot \text{Na}_2\text{SO}_4$, $\text{ZnO} \cdot \text{K}_2\text{SO}_4$, $3\text{CaO} \cdot \text{K}_2\text{SO}_3$, $\text{Mg}(\text{OH})_2 \cdot \text{MgSO}_4$, $5\text{MgO} \cdot \text{MgSO}_3$, $2\text{MgO} \cdot \text{MgSO}_3$, $\text{MgO} \cdot \text{CaSO}_3$, $5\text{CaO} \cdot \text{CaSO}_4$, $\text{Ca}(\text{OH})_2 \cdot \text{CaSO}_4$, $3\text{CaO} \cdot \text{CaSO}_3$, $\text{SrO} \cdot \text{SrSO}_2$, $3\text{BaO} \cdot \text{BaSO}_4$, $3\text{BaO} \cdot \text{CaSO}_3$, $\text{Ba}(\text{OH})_2 \cdot \text{BaSO}_4$, $\text{TiO}_2 \cdot \text{Ti}(\text{SO}_4)_2$, $\text{Al}_2\text{O}_3 \cdot \text{Al}_2(\text{SO}_4)_3$, $\text{Al}(\text{OH})_2 \cdot \text{MgSO}_4$, $\text{MgO} \cdot \text{Mg}_3(\text{BO}_4)_2$, $\text{CaO} \cdot (\text{BO}_4)_2$, $5\text{Ca}(\text{OH})_2 \cdot \text{Ca}_3(\text{BO}_4)_2$, $3\text{CaO} \cdot \text{Ca}(\text{BO}_2)_2$, $3\text{Ba}(\text{OH})_2 \cdot \text{Ba}_3(\text{BO}_4)_2$, $3\text{BaO} \cdot \text{BaB}_4\text{H}_7$, $5\text{Ba}(\text{OH})_2 \cdot \text{Ba}(\text{BO}_2)_2$, NaHCO_3 , $\text{Mg}(\text{HCO}_3)_2$, LiHCO_3 , BaCO_3 , MgCO_3 , ZnCO_3 and Li_2CO_3 .

[Perchlorate]

Examples of the perchlorate include perchloric acid ion-introduced hydrotalcite and salt of alkali-aluminum composite hydroxide, as well as lithium perchlorate, sodium perchlorate, magnesium perchlorate, calcium

perchlorate, barium perchlorate and zinc perchlorate. It is also allowable to use a complex of a perchlorate and a polyhydric alcohol. Preferred examples of the polyhydric alcohol include diethylene glycol monomethyl ether,

5 triethylene glycol or propylene glycol monomethyl ether.

[Ultraviolet Ray-Absorbing Agent]

Examples of the ultraviolet ray-absorbing agent include 2-hydroxybenzophenones such as 2,4-

10 dihydroxybenzophenone, 2-hydroxy-4-methoxybenzophenone, and 5,5'-methylenebis(2-hydroxy-4-methoxybenzophenone);

and 2-(2'-hydroxyphenyl) benzotriazoles such as 2-(2'-hydroxy-5'-methylphenyl) benzotriazole, 2-(2'-hydroxy-3'-tert-butyl-5'-methylphenyl)-5-chlorobenzotriazole, 2-(2'-hydroxy-5'-tert-octylphenyl) benzotriazole, 2-(2'-hydroxy-

15 3',5'-dicumylphenyl) benzotriazole, and 2,2'-methylenebis(4-tert-octyl-6-benzotriazolyl) phenol.

[Epoxy Compound]

Examples of the epoxy compound include epoxylated soybean oil, epoxylated linseed oil, epoxylated fish oil, 20 fatty acid ester of epoxylated tall oil, epoxylated tallow oil, epoxylated castor oil, epoxylated safflower oil, fatty acid butyl of epoxylated linseed oil,

tris(epoxypropyl) isocyanurate, 3-(2-oxo-1,2-epoxypropane, bisphenol-A diglycidyl ether,

25 vinylcyclohexene diepoxide, dicyclopentadiene diepoxide, and 3,4-epoxycyclohexyl-6-methylepoxy-cyclohexane carboxylate.

[Antistatic Agent]

The lubricating agent and the antistatic agent used 30 in the present invention may generally be those used for the polyolefin films. Preferred examples of the antistatic agent include (a) those of the cationic type such as primary amine salt, tertiary amine, quaternary ammonium compound, pyridine derivative, (b) those of the 35 anionic type such as sulfonated oil, soap, sulfonated

ester oil, sulfonated amide oil, sulfuric esters salts of olefin, fatty alcohol sulfuric ester salts, alkylsulfuric ester salts, fatty acid ethyl sulfonate salts, alkylnaphthalene sulfonate salts, alkylbenzene sulfonate salts, succinic ester sulfonate salts and phosphoric acid ester salts, (c) those of the nonionic type such as partial fatty acid ester of polyhydric alcohol, ethylene oxide adduct of fatty alcohol, ethylene oxide adduct of fatty acid, ethylene oxide adduct of fatty amino or fatty acid amide, ethylene oxide adduct of alkylphenol, ethylene oxide adduct of alkylnaphthol, ethylene oxide adduct of partial fatty acid ester of polyhydric alcohol, and polyethylene glycol, and (d) those of the amphoteric type such as carboxylic acid derivative and imidazoline derivative. In particular, it is desired to use those of the nonionic type and, among them, to use polyoxyethylenealkylamine, polyoxyethylenealkylamide or fatty acid ester thereof or fatty acid ester of glycerin. [Fatty Acid Esters of Monohydric and Polyhydric Alcohols]

Examples of the fatty acid ester include n-butyl stearate, hydrogenated rosin methyl ester, dibutyl(n-butyl) sebacate, sebacic acid dioctyl(2-ethylhexyl, n-octyl) glycerin fatty acid ester, pentaerythritol tetrastearate, polyethylene glycol fatty acid ester, polyethylene glycol distearate, polyethylene glycol dilaurate, polyethylene glycol dioleate, polyethylene glycol coconut fatty acid diester, polyethylene glycol tall oil fatty acid diester, ethane diol montanic acid diester, 1,3-butane diol montanic acid diester, diethylene glycol stearic acid diester, propylene glycol fatty acid diester, triglyceride wax, hydrogenated edible oil or fat, glycerin ester of 12-hydroxystearic acid, sperm acetiawax, montane wax, carnauba wax, bees wax, haze wax, monohydric fatty acid alcohol and saturated acid ester of fatty acid (e.g., cured whale oil lauryl stearate, stearyl stearate),

lanolin, polyethylene wax, polypropylene wax, oxidized polyethylene wax, acid-modified polyolefin wax, epoxy-modified polyethylene wax, and petroleum wax. There can be further used those containing a partial ester thereof.

- 5 Examples of the hindered amine compound include 1,2,2,6,6-pentamethyl-4-piperidyl stearate, 2,2,6,6-tetramethyl-4-piperidyl benzoate, N-(2,2,6,6-tetramethyl-4-piperidyl) dodecylsuccinic acid imide, 1-[(3,5-di-tert-butyl-4-hydroxyphenyl)propionyloxyethyl]-2,2,6,6-
- 10 tetramethyl-4-piperidyl-(3,5-di-tert-butyl-4-hydroxyphenyl) propionate, bis(2,2,6,6-tetramethyl-4-piperidyl) sebacate, tetra(2,2,6,6-tetramethyl-4-piperidyl) butane tetracarboxylate, tetra(1,2,2,6,6-pentamethyl-4-piperidyl) butane tetracarboxylate,
- 15 bis(2,2,6,6-tetramethyl-4-piperidyl)-di(tridecyl) butane tetracarboxylate, and bis(1,2,2,6,6-pentamethyl-4-piperidyl)-di(tridecyl) butane tetracarboxylate.

- In order to further improve electric insulating property, there can be blended amorphous silica, fired
- 20 kaolin, aluminum oxide, aluminum silicate, titanium white, titanium phosphate or zirconium phosphate in an amount of from 20 to 1000 parts by weight and, particularly, from 200 to 500 parts by weight per 100 parts by weight of the sum of the components (A) to (F).

25 [Chlorine-Containing Polymer Composition]

- The chlorine-containing polymer composition of the present invention is blended with the fine crystalline calcium silicate which is the component (A) (or (D) or with the composite (E) of the fine crystalline calcium
- 30 silicate and a polyhydric alcohol of a weight ratio of 20:80 to 80:20), in an amount of from 0.2 to 10 parts by weight and, particularly, from 0.5 to 5 parts by weight, and with (C) the hydrotalcite or the alkali-aluminum composite hydroxide in an amount of from 0.1 to 10 parts
- 35 by weight and, particularly, from 0.2 to 0.5 parts by

weight per 100 parts by weight of the chlorine-containing polymer.

Examples of the chlorine-containing polymer include polymers such as polyvinyl chloride, polyvinylidene chloride, chlorinated polyvinyl chloride, chlorinated polyethylene, chlorinated polypropylene, chlorinated rubber, vinyl chloride/vinyl acetate copolymer, vinyl chloride/ethylene copolymer, vinyl chloride/propylene copolymer, vinyl chloride/styrene copolymer, vinyl chloride/isobutylene copolymer, vinyl chloride/vinylidene chloride copolymer, vinyl chloride/styrene/maleic anhydride tercopolymer, vinyl chloride/styrene/acrylonitrile copolymer, vinyl chloride/butadiene copolymer, chlorinated vinyl/propylene chloride copolymer, vinyl chloride/vinylidene chloride/vinyl acetate tercopolymer, vinyl chloride/acrylic ester copolymer, vinyl chloride/maleic ester copolymer, vinyl chloride/methacrylic ester copolymer, vinyl chloride/acrylonitrile copolymer, and internally plasticized polyvinyl chloride; blends thereof with α -olefin polymers such as polyethylene, polypropylene, polybutene or poly-3-methylbutene, or with polyolefins and such as ethylene/vinyl acetate copolymers ethylene/propylene copolymer, etc., or with a copolymer of polystyrene, acrylic resin or styrene and other monomer (e.g., anhydrous maleic acid, butadiene, acrylonitrile, etc.), or with acrylonitrile/butadiene/styrene copolymer, acrylic ester/butadiene/styrene copolymer, or methacrylic ester/butadiene/styrene copolymer.

The stabilizing agent of the present invention is effective in thermally stabilizing the chlorine-containing polymer. The kind of the stabilizing agent can be selected depending upon the kind of the chlorine-containing polymer. For example, when the chlorine-containing polymer is a vinyl chloride resin, it is

desired that the component (C) is a hydrotalcite and when the chlorine-containing polymer is a chlorinated vinyl chloride resin, it is desired that the component (C) is an alkali-aluminum composite hydroxide.

5 In the composition of the present invention, it is desired that (F) the higher fatty acid zinc is blended in an amount of from 0.1 to 5.0 parts by weight and, particularly, from 0.2 to 2.0 parts by weight per 100 parts by weight of the chlorine-containing polymer, and
10 that (G) the phenol-type antioxidizing agent is blended in an amount of from 0.01 to 5.0 parts by weight and, particularly, from 0.05 to 2.0 parts by weight per 100 parts by weight of the chlorine-containing polymer. When the hydrotalcite is a zinc-modified hydrotalcite, it is
15 desired that (H) the β -diketone or the β -keto-acid ester is blended in an amount of from 0.01 to 5.0 parts by weight and, particularly, from 0.03 to 1.0 parts by weight per 100 parts by weight of the chlorine-containing polymer.

20 The chlorine-containing polymer composition of the present invention can be blended with known blending agents for chlorine-containing polymers according to a known method. For example, the composition of the present invention can be blended with a plasticizer, lubricating
25 agent, filler, coloring agent, weatherability stabilizer, aging-preventing agent, photo stabilizer, ultraviolet ray-absorbing agent, antistatic agent, reinforcing agent, resin or rubber for reforming, etc. according to a known recipe.

30 As the plasticizer, there can be used an ester-type plasticizer such as phthalic ester-type plasticizer or adipic ester-type plasticizer, or polyester-type plasticizer, phosphoric ester-type plasticizer, chlorine-type plasticizer, tetrahydrophthalic acid-type
35 plasticizer, azelaic acid-type plasticizer, sebacic acid-

type plasticizer, stearic acid-type plasticizer, citric acid-type plasticizer, trimellitic acid-type plasticizer, and pyromellitic acid-type plasticizer.

As the lubricating agent, there are usually used (a) the one of the hydrocarbon type, such as fluidized, natural or synthetic paraffin, microwax, polyethylene wax, or chlorinated polyethylene wax, (b) the one of the fatty acid type such as stearic acid or lauric acid, (c) the one of the fatty acid monoamide type or biamide type, such as amide stearate, amide palmitate, amide oleate, amide esilate, methylenebis stearoamide, or ethylenebis stearoamide, (d) the one of the ester type such as butyl stearate, cured castor oil, or ethylene glycol monostearate, (e) the one of the alcohol type, such as cetyl alcohol or stearyl alcohol, (f) a metal soap such as lead stearate or calcium stearate, and (g) a mixture system thereof.

As the shock-resisting agent, there can be used chlorinated polyethylene containing, for example, 30 to 40% of chlorine, multi-component type resin obtained by graft-polymerizing a copolymerizable rubber composed chiefly of acrylic ester with methyl methacrylate, styrene or acrylonitrile, acrylonitrile/butadiene/styrene resin, methyl methacrylate/butadiene/styrene resin, or vinyl acetate/ethylene copolymer resin.

As the flame-retarding agent, there can be used halogen-type flame-retarding agent as well as oxide, hydroxide or sulfide of antimony, zirconium, molybdenum, aluminum, silica or titanium, or zinc borate, zinc stannate, zinc hydroxystannate, or zinc compound thereof of which the surface is treated with a metal hydroxide.

[EXAMPLES]

The invention will now be described by way of the following Working Examples to which only, however, the invention is in no way limited. In Examples, measurements

were taken in compliance with the methods described below.

(1) Evaluation of initial coloring.

A piece of sheet was heated in the Geer's oven at 190°C for 10 minutes, and the color tone was judged by eyes and was evaluated as follows:

1	2	3	4
Colorless	Pale yellow	Yellow	Red

(2) Geer's oven heat resistance.

A knead-molded PVC sheet was heated in an oven at 190°C and the time (in minutes) was measured until it was colored to evaluate its heat resistance.

(3) Heat Stability (H.T).

Measured by the hydrogen chloride-trapping testing based on a Congo Red method at 180°C in compliance with JIS-K-6723.

(4) Volume resistivity.

The volume resistivity was measured by using ADVANTEST R8340 while applying a voltage of 500 V.

(5) Aging testing at low temperatures.

A composition shown in Table 5 was kneaded by a roll mill at 160°C for 5 minutes, and a soft vinyl chloride sheet having a uniform thickness of 1 mm was taken out three days after to observe and judge the colored state.

The degree of coloring of the sheet was evaluated being divided into the following four stages.

0 > 1 > 2 > 3

white pink

(Synthesizing Example 1)

Concretely described below is a method of synthesizing the fine crystalline calcium silicate used in Examples of the present invention. 498.8 Grams of a slurry of a milk of lime (CaO content of 6%) and 42.8 g of an active silicic acid powder having an average particle

size of 5 microns were introduced into a ceramic pot mill, and were ground and reacted for 54 hours to obtain a slurry having a pH of 10. The slurry was filtered, washed with water, dried at 110°C and was pulverized in a small
5 sample mill to obtain a fine powdery calcium-silica composite hydroxide (CSH-1). Its properties were as shown in Table 4. Similarly, furthermore, CSH-2 and CSH-3 were synthesized while changing the ratio of the active silicic acid to the milk of lime, so that the Ca/Si molar ratios
10 of the fine powdery calcium-silica composite oxide were 0.4 and 2.5.

(Synthesis Example 2)

Concretely described below is a method of synthesizing a ground mixture of a fine crystalline
15 calcium silicate and a polyhydric alcohol used in Examples of the present invention.

285 Grams of a slurry of a milk of lime (CaO content of 6%), 24.2 g of an active silicic acid powder having an average particle size of 5 microns, and 40 g of a
20 dipentaerythritol were introduced into a ceramic pot mill, and were ground and reacted for 54 hours to obtain a slurry having a pH of 10. The slurry was filtered, washed with water, dried at 110°C, and was pulverized in a small sample mill to obtain a fine powdery calcium-silica
25 composite hydroxide (CASH) coated with the polyhydric alcohol. Its properties were as shown in Table 4.

30

35

Table 4

		<u>CSH-1</u>	<u>CSH-2</u>	<u>CSH-3</u>	<u>CASH</u>	<u>Xonotlite</u>
5	Ig loss (1000°C)	13.54	12.71	13.68	63.41	2.5
	CaO (% by wt.)	37.35	23.57	60.17	15.41	47.1
10	SiO ₂ (% by wt.)	48.95	69.48	25.97	20.69	50.4
	Ca/Si molar ratio	0.8	0.4	2.5	0.8	1.0
	Index of lamination asymmetry	1.96	1.90	1.89	1.96	1.20
20	Oil-absorbing amount (ml/100 g)	110	128	90	-	148
25	Average particle diameter (μm)	4	4.3	4.5	-	6.7
	Porous volume (ml/g)	3.10	-	-	-	-
30						

(Examples 1 to 5, Comparative Examples 1 to 3)

The following composition was kneaded using a kneading roll heated at 160°C for 5 minutes to prepare a sheet having a thickness of about 1 mm. Test pieces were

prepared from the sheet and were measured for their heat resistance in the Geer's oven, heat stability, and aging at low temperatures. The results were as shown in Table 5.

5 (Blending for Soft Polymers)

	Number of parts blended
PVC (TK-1300, produced by Shin-Etsu Kagaku Kogyo Co.)	100
DINP (plasticizer): Diiso-	
10 nonyl phthalate	50
Zinc stearate	0.5
β -Diketone	0.1
Phenol-type antioxidizing agent	0.1
15 Sample	Table 5

(Examples 6 to 12, Comparative Examples 4 to 6)

The following composition was kneaded using a kneading roll heated at 160°C for 5 minutes to prepare a sheet having a predetermined thickness. Test pieces were
20 prepared from the sheet and were measured for their heat resistance in the Geer's oven, heat stability, and aging at low temperatures. The results were as shown in Table 6.

(Blending for Hard Polymers)

	Number of parts blended
PVC (TK-1300, produced by Shin-Etsu Kagaku Kogyo Co.)	100
Zinc stearate	1.0
β -Diketone	0.1
30 Fatty acid ester-type wax	0.5
Phenol-type antioxidizing agent	0.1
Sample	Table 6

Table 5 (Soft polymer system)

	Example					Comparative Example		
	1	2	3	4	5	1	2	3
<u>PVC</u>	100	100	100	100	100	100	100	100
<u>DINP</u>	50	50	50	50	50	50	50	50
<u>Isocyanurate</u>	0.1	0.02	0.1	0.3	0.5		0.1	0.1
<u>CSH-1</u>	0.5	0.5		1.5		0.5		
<u>CSH-2</u>					0.5			
<u>CASH</u>			0.5					
<u>Xonolite</u>								0.5
<u>Alkamizer 7</u>	2	2	2	1.0	2	2	2	2
<u>Zinc stearate</u>	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
<u>β-Diketone</u>	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
<u>Phenol-type antioxidant agent</u>	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
<u>Geer's oven heat resistance</u>								
Before heating	1	1	1	1	1	1	1	1
20 min.	1	1	1	1	1	1	2	2
40 min.	2	2	2	1	1	2	3	3
60 min.	2	2	3	2	2	2	4	3
80 min.	3	3	3	3	2	3	5	4
100 min.	3	3	3	4	2	3	6	5
120 min.	4	4	4	5	3	4		6
160 min.	6	6	6	6	5	6		
Heat stability (min.)	362	362	304	222	412	340	267	300
<u>Aging at low temperature</u>								
Before heating	0	0	0	0	0	0	0	0
3 days after heating	0	0	0	0	0	2	0	0
5 days after heating	0	1	0	0	0	3	0	1
7 days after heating	0	1	0	0	0	3	1	1

Table 6 (Hard polymer system)

	Example												Comparative Example			
	6	7	8	9	10	11	12	4	5	6						
PVC	100	100	100	100	100	100	100	100	100	100						
Isocyanurate	0.3	0.1	0.3	0.5	0.5	0.3	0.3			0.3						
CSH-1	0.3		0.5		0.5											
CSH-2							0.3									
CASH		0.5		0.5		0.5		0.5								
Alkamizer 7	2		0.5			1.5	2									
Mizukalac H-1		2	1.5	2	2			2	2.5	0.5						
Dawsonite						1.5										
Zinc stearate	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0						
β -Diketone	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1						
Wax	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5						
Phenol-type antioxidant agent	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1						
Geer's oven heat resistance																
0 min.	1	1	1	1	1	1	1	1	1	1						
10 min.	2	4	3	3	3	2	2	4	4	4						
20 min.	4	4	4	3	3	2	4	4	4	4						
40 min.	5	5	5	4	4	3	5	5	5	5						
60 min.	6	5	5	5	5	3	6	5	5	5						
90 min.		6	6	6	6	4		6	6	6						
Heat stability (min.)	181	121	127	127	126	205	185	121	108	157						
Before heating	0	0	0	0	0	0	0	0	0	0						
1 day after heating	1	2	1	0	0	1	1	3	1	3						
2 days after heating	2	2	2	1	1	2	2	3	2	3						
3 days after heating	2	3	2	1	1	2	2	3	2	3						

(Examples 13 to 17, Comparative Examples 7 and 8)

The following composition was kneaded using a kneading roll heated at 150°C for 7 minutes to prepare a sheet having a thickness of 0.5 mm. Test pieces were prepared from the sheet and were measured for their initial coloring, heat resistance in the Geer's oven, heat stability, and volume resistivity. The results were as shown in Table 7.

(Blending)

	Parts by weight
Polyvinyl chloride resin (polymerization degree = 1050)	100
Dioctyl phthalate	50
Sample	Table 7

Table 7

	<u>Examples</u>					<u>Comp. Examples</u>	
	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>7</u>	<u>8</u>
Alkamizer 4	1.4	0.6	1.4	1.4	1.4	2.0	
CSH-1	0.6	1.4	0.6	0.6	0.6		2.0
Zinc stearate			0.4	0.4	0.4		
Bisphenol A				0.1	0.1		
Dibenzoylmethane					0.05		
Initial coloring	3	3	1	1	1	4	4
Geer's oven heat resistance (min)	100	100	100	100	100	100	140
Heat stability (min)	87	52	134	197	206	82	31
Volume resistivity (x 10 ¹³ Ω-cm)	6.42	8.91	7.70	5.83	5.03	3.10	10.48

(Examples 18 to 20, Comparative Examples 9 to 12)

The following composition was kneaded using a

kneading roll heated at 150°C for 7 minutes to prepare a sheet having a thickness of 0.5 mm. Test pieces were prepared from the sheet and were measured for their initial coloring, heat resistance in the Geer's oven, heat stability, and volume resistivity. The results were as shown in Table 8.

(Blending)

	Parts by weight
Polyvinyl chloride resin	
10 (polymerization degree = 1050)	100
Diethyl phthalate	50
Zinc stearate	0.4
Bisphenol A	0.1
Dibenzoylmethane	0.1
15 Alkamizer 4	2.0
Sample	Table 8

Table 8

	<u>Examples</u>			<u>Comp. Examples</u>			
	<u>18</u>	<u>19</u>	<u>20</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>
20 CSH-1	0.3	0.5	1.0				
Xonotlite					0.5		
25 CSH-2						0.5	
CSH-3							0.5
Initial coloring	1	1	1	2	2	1	3
Geer's oven heat resistance (min)	140	160	180	< 100	100	140	140
30 Heat stability (min)	299	312	350	264	265	275	268
Volume resistivity (x 10 ¹³ Ω-cm)	4.1	4.6	6.0	1.5	2.0	3.4	2.4

(Examples 21 to 25, Comparative Examples 13 and 14)

The following composition was kneaded using a kneading roll heated at 150°C for 7 minutes to prepare a sheet having a thickness of 0.5 mm. Test pieces were prepared from the sheet and were measured for their heat resistance in the Geer's oven, heat stability, and volume resistivity. The results were as shown in Table 9.

(Blending)

	Parts by weight
10 Polyvinyl chloride resin (polymerization degree = 1050)	100
Diocetyl phthalate	50
Zinc stearate	0.4
Bisphenol A	0.1
15 Dibenzoylmethane	0.1
CSH-1	0.5
Sample	Table 9

Table 9

	<u>Examples</u>					<u>Comp. Ex.</u>	
	<u>21</u>	<u>22</u>	<u>23</u>	<u>24</u>	<u>25</u>	<u>13</u>	<u>14</u>
Alkamizer-4	1.0	2.0	3.0				
25 Alkamizer-1				2.0			
DHT-4					2.0		
Calcium stearate							1.0
Geer's oven heat resistance (min)	100	160	180	< 120	140	10	20
30 Heat stability (min)	278	312	493	330	337	11	30
Volume resistivity (x 10 ¹³ Ω-cm)	4.2	4.6	4.7	5.3	5.0	0.3	1.2

35 *Alkamizer-4: Zinc-modified hydrotalcite (produced by

Kyowa Kagaku Kogyo Co.)

*DHT-4: Hydrotalcite (produced by Kyowa Kagaku Kogyo Co.)

*Alkamizer-1: Hydrotalcite (produced by Kyowa Kagaku Kogyo Co.)

5

(Examples 26 to 29, Comparative Examples 15 and 16)

The following composition was kneaded using a kneading roll heated at 150°C for 7 minutes to prepare a sheet having a thickness of 0.5 mm. Test pieces were prepared from the sheet and were measured for their heat resistance in the Geer's oven, heat stability, and volume resistivity. The results were as shown in Table 10.

(Blending)

	Parts by weight
15 Polyvinyl chloride resin (polymerization degree = 1050)	100
Diocetyl phthalate	50
Zinc stearate	0.8
Bisphenol A	0.1
20 Dibenzoylmethane	0.1
Alkamizer 4	0.5
Sample	Table 10

25

30

35

Table 10

	<u>Examples</u>				<u>Comp. Ex.</u>	
	<u>26</u>	<u>27</u>	<u>28</u>	<u>29</u>	<u>15</u>	<u>16</u>
5						
	CASH	1.5	3.0			
	CSH-1+Di-P (1:1)			1.5		
	CSH-2+Di-P (1:1)				1.5	
	CSH-3+Di-P (1:1)					1.5
10	Geer's oven heat		160~			
	resistance (min)	140	180	120	180	100
	Heat stability					
	(min)	192	286	158	238	122
	Volume resistivity					
15	($\times 10^{13} \Omega\text{-cm}$)	6.3	6.9	6.2	6.7	4.5

*CSH1 to 3+Di-P: Simple mixture of CSH1 to 3 and
dipentaerythritol

20 (Examples 30 to 32, Comparative Example 17)

The dipentaerythritol of Synthesis Example 2 was replaced by mannitol to obtain dry-ground and mixed fine powdery calcium-silica composite particles (CASH-M) coated with the polyhydric alcohol. Similarly, the

25 dipentaerythritol of Synthesis Example 2 was replaced by dipentaerythritol adipate to obtain dry-ground and mixed fine powdery calcium-silica composite particles (CASH-S) coated with the polyhydric alcohol.

The following composition was kneaded using a
30 kneading roll heated at 150°C for 7 minutes to prepare a sheet having a thickness of 0.5 mm. Test pieces were prepared from the sheet and were measured for their heat resistance in the Geer's oven, heat stability, and volume resistivity. The results were as shown in Table 11.

35

(Blending)

		Parts by weight
	Polyvinyl chloride resin (polymerization degree = 1050)	100
5	Dioctyl phthalate	50
	Zinc stearate	0.5
	Bisphenol A	0.1
	Dibenzoylmethane	0.01
	Alkamizer 4	1.0
10	Sample	Table 11

Table 11

		<u>Examples</u>			<u>Comp. Ex.</u>
		<u>30</u>	<u>31</u>	<u>32</u>	<u>17</u>
15	CASH	1.0			
	CASH-M		1.0		
	CASH-S			1.0	
20	Geer's oven heat resistance (min)	140	140	140	40
	Heat stability (min)	220	205	213	86
25	Volume resistivity ($\times 10^{13} \Omega\text{-cm}$)	5.2	8.7	5.1	5.0

(Examples 33 to 36, Comparative Example 18)

The following composition was kneaded using a kneading roll heated at 150°C for 7 minutes to prepare a sheet having a thickness of 0.5 mm. Test pieces were prepared from the sheet and were measured for their heat resistance in the Geer's oven, heat stability, and volume resistivity. The results were as shown in Table 12.

(Blending)

Parts by weight

	Chlorinated vinyl chloride resin (chlorine content of 67%)	100
5	Dioctyl phthalate	50
	Zinc stearate	0.4
	Bisphenol A	0.1
	Dibenzoylmethane	0.05
	Sample	Table 12

10

Table 12

		<u>Examples</u>				<u>Comp. Ex.</u>
		<u>33</u>	<u>34</u>	<u>35</u>	<u>36</u>	<u>18</u>
15	CASH	1.0	1.0	1.0	0.6	2.0
	Alkamizer-4	1.0			1.4	
	Mizukalac		1.0			
	Dawsonite			1.0		
20	Geer's oven heat			140~		
	resistance (min)	140	160	160	80	60
	Heat stability					
	(min)	102	105	93	100	85
	Volume resistivity					
25	(x 10 ¹³ Ω-cm)	24.1	26.1	5.0	8.5	4.5

- 25
- *Mizukalac: carbonate of lithium-aluminum composite
hydroxide (produced by Mizusawa Kagaku Kogyo Co.)
- *Dawsonite: carbonate of sodium-aluminum composite
hydroxide (produced by Mizusawa Kagaku Kogyo Co.)
- 30

According to the present invention, a fine
crystalline calcium silicate having a particular
composition and X-ray diffraction image is selected out of
35 the calcium silicate, and is used in combination with an

isocyanurate compound and/or a hydrotalcite or an alkali-aluminum composite hydroxide, in order to obtain a chlorine-containing polymer composition having markedly improved heat stability, markedly improved resistance
5 against the aging at low temperatures, excellent electrically insulating property and improved initial coloring.

When a composite is formed from the fine crystalline calcium silicate and a polyhydric alcohol, and is used in
10 combination with the isocyanurate compound and/or the hydrotalcite or the alkali-aluminum composite hydroxide, it is allowed to further improve the heat stability and to prevent the initial coloring.

15

20

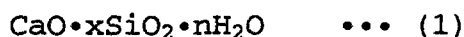
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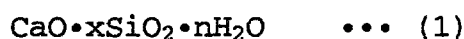
CLAIMS:

1. A stabilizer for chlorine-containing polymers comprising (A) a fine crystalline calcium silicate having
5 a chemical composition expressed by the following general formula (1),



- 10 wherein x is a number of not smaller than 0.5, and
n is a number of not larger than 2.5,
and having an X-ray diffraction image in the spacing of
from 3.01 to 3.08 angstroms, in the spacing of from 2.78
to 2.82 angstroms and in the spacing of from 1.81 to 1.84
15 angstroms, and (B) an isocyanurate compound, the fine
crystalline calcium silicate (A) and the isocyanurate
compound (B) being contained at a weight ratio of from
5:95 to 99.8:0.2.

2. A stabilizer for chlorine-containing polymers
20 comprising (A) a fine crystalline calcium silicate having
a chemical composition expressed by the following general
formula (1),



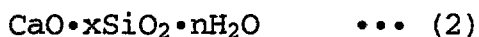
- 25 wherein x is a number of not smaller than 0.5, and
n is a number of not larger than 2.5,
and having an X-ray diffraction image in the spacing of
from 3.01 to 3.08 angstroms, in the spacing of from 2.78
30 to 2.82 angstroms and in the spacing of from 1.81 to 1.84
angstroms, (B) an isocyanurate compound, and (C) a
hydrotalcite or an alkali-aluminum composite, the
isocyanurate compound (B) being made present at a weight
ratio of from 0.5 to 50 per 100 parts by weight of the sum
35 of the components (A) and (C).



3. A stabilizer for chlorine-containing polymers according to claim 1, wherein the isocyanurate compound (B) is a tris(hydroxyalkyl) isocyanulate.

4. A stabilizer for chlorine-containing polymers according to claim 2, wherein the isocyanurate compound (B) is a tris(hydroxyalkyl) isocyanulate.

5. A stabilizer for chlorine-containing polymers comprising (D) a fine crystalline calcium silicate having a chemical composition expressed by the following formula
10 (2),



wherein x is a number of from 0.5 to 2.0, and
15 n is a number of not larger than 2.5,
and having an X-ray diffraction image in the spacing of from 3.01 to 3.08 angstroms, in the spacing of from 2.78 to 2.82 angstroms and in the spacing of from 1.81 to 1.84 angstroms, and (C) a hydrotalcite or a salt of an alkali-
20 aluminum composite hydroxide, at a weight ratio of from 0.5:99.5 to 99:1.

6. A stabilizer for chlorine-containing polymers according to claim 1, wherein the fine crystalline calcium silicate (A) is a composite (E) thereof containing the
25 fine crystalline calcium silicate (A) and a polyhydric alcohol at a weight ratio of from 20:80 to 80:20.

7. A stabilizer for chlorine-containing polymers according to claim 1, wherein the fine crystalline calcium silicate (A) has an index of laminated asymmetry
30 (Is) as defined by the following formula (3),

$$I_s = \tan \theta_2 / \tan \theta_1 \quad \dots (3)$$

wherein θ_1 is an angle subtended by a peak
35 perpendicular in an X-ray diffraction peak of a



spacing of 3.01 to 3.08 angstroms and a tangent of the side of a narrow angle, and θ_2 is an angle subtended by a peak perpendicular in the above-mentioned peak and a tangent of the side of a broad angle,

of not smaller than 1.75.

8. A stabilizer for chlorine-containing polymers according to claim 1, wherein the fine crystalline calcium silicate (A) has a specific surface area of from 60 to 200 m²/g, a porous volume of not smaller than 0.5 ml/g, an oil-absorbing amount of from 50 to 250 ml/100 g, and an average particle diameter of from 0.1 to 10 μ m.

9. A stabilizer for chlorine-containing polymers according to claim 6, wherein the composite (E) of the fine crystalline calcium silicate (A) and the polyhydric alcohol is obtained by wet- or dry-pulverizing the fine crystalline calcium silicate and the polyhydric alcohol together.

10. A stabilizer for chlorine-containing polymers according to claim 6, wherein the polyhydric alcohol is a pentaerythritol or a dipentaerythritol.

11. A stabilizer for chlorine-containing polymers according to claim 2, wherein (F) from 5 to 70 parts by weight of a higher fatty acid zinc is further contained per 100 parts by weight of the sum of the components (A) and (C).

12. A stabilizer for chlorine-containing polymers according to claim 2, wherein (G) from 1 to 50 parts by weight of a phenol-type antioxidizing agent is further contained per 100 parts by weight of the sum of the components (A) and (C).

13. A stabilizer for chlorine-containing polymers according to claim 2, wherein the hydrotalcite is a zinc-modified hydrotalcite.

14. A stabilizer for chlorine-containing polymers



according to claim 2, wherein (H) from 0.5 to 30 parts by weight of a β -diketone or a β -keto-acid ester is further contained per 100 parts by weight of the sum of the components (A) and (C).

5 15. A stabilizer for chlorine-containing polymers according to claim 2, wherein the salt of the alkali-aluminum composite hydroxide is a carbonate of a lithium-aluminum composite hydroxide.

10 16. A stabilizer for chlorine-containing polymers according to claim 2, wherein the salt of the alkali-aluminum composite hydroxide is a dawsonite-type carbonate of a sodium-aluminum composite hydroxide.

15 17. A stabilizer for chlorine-containing polymers according to claim 5, wherein the fine crystalline calcium silicate (D) is a composite (E) thereof containing the fine crystalline calcium silicate (A) and a polyhydric alcohol at a weight ratio of from 20:80 to 80:20.

20 18. A stabilizer for chlorine-containing polymers according to claim 5, wherein the fine crystalline calcium silicate (D) has an index of laminated asymmetry (Is) as defined by the following formula (3),

$$Is = \tan \theta_2 / \tan \theta_1 \quad \dots (3)$$

25 wherein θ_1 is an angle subtended by a peak perpendicular in an X-ray diffraction peak of a spacing of 3.01 to 3.08 angstroms and a tangent of the side of a narrow angle, and θ_2 is an angle subtended by a peak perpendicular in the above-mentioned peak and a tangent of the side of a broad angle,

of not smaller than 1.75.

35 19. A stabilizer for chlorine-containing polymers according to claim 5, wherein the fine crystalline calcium silicate (D) has a specific surface area of from 60 to 200



m²/g, a porous volume of not smaller than 0.5 ml/g, an oil-absorbing amount of from 50 to 250 ml/100 g, and an average particle diameter of from 0.1 to 10 μ m.

20. A stabilizer for chlorine-containing polymers according to claim 17, wherein the composite (E) of the fine crystalline calcium silicate (D) and the polyhydric alcohol is obtained by wet- or dry-pulverizing the fine crystalline calcium silicate and the polyhydric alcohol together.

21. A stabilizer for chlorine-containing polymers according to claim 17, wherein the polyhydric alcohol is a pentaerythritol or a dipentaerythritol.

22. A stabilizer for chlorine-containing polymers according to claim 5, wherein (F) from 5 to 70 parts by weight of a higher fatty acid zinc is further contained per 100 parts by weight of the sum of the components (A) and (C).

23. A stabilizer for chlorine-containing polymers according to claim 5, wherein (G) from 1 to 50 parts by weight of a phenol-type antioxidizing agent is further contained per 100 parts by weight of the sum of the components (D) and (C).

24. A stabilizer for chlorine-containing polymers according to claim 5, wherein the hydrotalcite is a zinc-modified hydrotalcite.

25. A stabilizer for chlorine-containing polymers according to claim 5, wherein (H) from 0.5 to 30 parts by weight of a β -diketone or a β -keto-acid ester is further contained per 100 parts by weight of the sum of the components (D) and (C).

26. A stabilizer for chlorine-containing polymers according to claim 5, wherein the salt of the alkali-aluminum composite hydroxide is a carbonate of a lithium-aluminum composite hydroxide.

27. A stabilizer for chlorine-containing polymers



according to claim 5, wherein the salt of the alkali-aluminum composite hydroxide is a dawsonite-type carbonate of a sodium-aluminum composite hydroxide.

28. A stabilized chlorine-containing polymer
5 composition comprising (A) from 0.2 to 10 parts by weight of a fine crystalline calcium silicate having a chemical composition expressed by the following general formula (1),



wherein x is a number of not smaller than 0.5 and, particularly, from 0.5 to 2.0, and n is a number of not larger than 2.5,

- 15 and having an X-ray diffraction image in the spacing of from 3.01 to 3.08 angstroms, in the spacing of from 2.78 to 2.82 angstroms and in the spacing of from 1.81 to 1.84 angstroms, or a composite (E) thereof with a polyhydric alcohol, (B) from 0.01 to 3 parts by weight of an
20 isocyanurate compound, and/or (C) from 0.1 to 10 parts by weight of a hydrotalcite or a salt of an alkali-aluminum composite hydroxide, per 100 parts by weight of the chlorine-containing polymer.

29. A chlorine-containing polymer composition
25 according to claim 28, wherein the chlorine-containing polymer is a vinyl chloride resin, and the component (B) is a tris(hydroxyalkyl) isocyanurate.

30. A chlorine-containing polymer composition according to claim 28, wherein the chlorine-containing
30 polymer is a vinyl chloride resin, and the component (C) is a hydrotalcite.

31. A chlorine-containing polymer composition according to claim 28, wherein the chlorine-containing
polymer is a chlorinated vinyl chloride resin, and the
35 component (C) is a salt of an alkali-aluminum composite



hydroxide.

32. A chlorine-containing polymer composition according to any one of claims 28, wherein (F) from 0.1 to 5.0 parts by weight of a higher fatty acid zinc is further
5 contained per 100 parts by weight of the chlorine-containing polymer.

33. A chlorine-containing polymer composition according to any one of claims 28, wherein (G) from 0.01 to 5.0 parts by weight of a phenol-type antioxidizing
10 agent is further contained per 100 parts by weight of the chlorine-containing polymer.

34. A stabilizer for chlorine-containing polymers according to claim 28, wherein the hydrotalcite is a zinc-modified hydrotalcite.

15 35. A chlorine-containing polymer composition according to any one of claims 28, wherein (H) from 0.01 to 5.0 parts by weight of a β -diketone or a β -keto-acid ester is further contained per 100 parts by weight of the chlorine-containing polymer.
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