

PATENT SPECIFICATION

(11) 1 585 877

1585 877
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- (21) Application No. 24403/77 (22) Filed 10 June 1977
(31) Convention Application No. 51/068 406
(32) Filed 11 June 1976
(31) Convention Application No. 51/072 022
(32) Filed 18 June 1976
(31) Convention Application No. 51/148 538
(32) Filed 10 Dec. 1976 in
(33) Japan (JP)
(44) Complete Specification published 11 March 1981
(51) INT CL³ G11B 3/70
(52) Index at acceptance
C3V EU
C3W 205D 213D 225 225B 226 226B
C3Y B390 B393 F118 F530 G200 H440 H600



(54) INFORMATION SIGNAL RECORDING DISC

(71) We, KUREHA KAGAKU KOGYO KABUSHIKI KAISHA, a company organised and existing under the Laws of Japan, of 8, Nihonbashi Horidome-Cho 1-Chome, Chuo-ku, Tokyo-to, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates generally to media for the recording of information signals such as phonograph and video disc media and to materials therefor, the signals thus recorded being reproducible from the media. More particularly, the invention relates to a phonograph or video disc which is fabricated from a copolymer containing an unsaturated nitrile component and has highly desirable properties such as an antistatic property, abrasion resistance, impact resistance, heat stability, transparency, and homogeneity.

The material mostly used for phonograph discs at present is a vinyl chloride — vinyl acetate copolymer of low molecular weight. Furthermore, vinyl chloride resins produced by emulsion polymerization have been considered as materials for video discs which have been developed recently. Phonograph and video discs in which vinyl chloride resins are used are accompanied by a number of problems as described below.

1. The first problem is that a phonograph disc in which a vinyl chloride — vinyl acetate copolymer, or a video disc in which a vinyl chloride (VC) resin produced by emulsion polymerization (hereinafter referred to collectively as "VC resin record discs") is used exhibits a conspicuous electrostatic charge accumulating characteristic (hereinafter referred to as an "electrostatic characteristic"). This electrostatic characteristic is still of remarkable degree even in the case where an antistatic agent has been applied as a coating on the surface of the phonograph disc or has been kneaded into the disc resin.

As is known, an electrostatic characteristic of this degree gives rise to the attraction of dust in the air and the surroundings to the phonograph disc surface and thus into the recording groove. As a consequence of this dust in the groove, not only is noise generated at the time of reproducing (playing) of the record disc, but the serviceable life of the reproducing stylus is shortened, and the groove walls are damaged, whereby the serviceable life of the disc itself is reduced. While various cleaners for removing this dust in the disc groove are being sold on the market, they are troublesome because they must be used every time a disc is to be played. Furthermore, in the case of a video disc, the presence of dust in the disc groove has a more deleterious effect because of the high-density recording.

2. The second problem is that vinyl chloride resins, particularly vinyl chloride resins produced by emulsion polymerization, having poor heat stability and their decomposition temperatures are close to their processing temperatures, so that these resins readily decompose or undergo degeneration. In order to improve the heat stability of these resins, it is a common practice to add stabilizers thereto, but this measure cannot be said to be completely satisfactory. Moreover, a stabilizer

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agent used in this manner bleeds out of the surface of the record disc after forming and becomes a cause of noise.

3. The third problem is that, in order to produce resins of good formability and workability, these VC resins are produced with a low molecular weight and as copolymers with vinyl acetate. For this reason, these resins have poor heat resistance and poor abrasion resistance and, in the form of a record disc, are easily warped and easily scratched or scored.

Heretofore, new high-polymer materials in which the above-described problems accompanying vinyl chloride resins have been overcome have been proposed but, because they entail other problems, have not replaced VC resins for recording discs. For example, as is known polystyrene resins have poor abrasion resistance and poor impact resistance, while polymethacrylate resins have poor fluidity at forming or moulding, poor abrasion resistance, and poor impact resistance.

It is an object of this invention to provide a record disc in which the above-described problems accompanying VC resin record discs and the record discs of resins other than VC resins are overcome, and which has a good antistatic property, heat stability, heat resistance, abrasion resistance, impact resistance, and other desirable characteristics.

According to this invention, there is provided an information signal recording disc such as a phonograph or video disc comprising a constituent resin comprising at least one unsaturated nitrile graft copolymer and having therein an unsaturated nitrile content of from 40 to 90 percent by weight, said resin exhibiting a Clash-Berg flex temperature of from 50 to 120°C, an absorbed impact energy of at least 0.5 kg.cm. when tested with a test specimen thereof of 2-mm. thickness by a Dynstat impact test according to BS—1330—1946, and a Shore D hardness of from 75 to 95.

Further features of this invention will be more clearly apparent from the following detailed description beginning with a consideration of general features of the invention and concluding with specific examples of practice illustrating preferred embodiments of the invention.

A requisite of the constituent resin of the recording disc of this invention is that it should contain, within its composition, from 40 to 90 percent, preferably from 50 to 85 percent, by weight of the unsaturated nitrile. Typically representative unsaturated nitriles are acrylonitrile and methacrylonitrile. If the content of the unsaturated nitrile is less than 50 percent, particularly less than 40 percent, by weight, the electrostatic characteristic of the disc will increase. On the other hand, if this content exceeds 85 percent, in particular exceeds 90 percent, by weight, the resin will become crystalline. This is undesirable since not only will the noise increase but, in the case of acrylonitrile, the heat stability will deteriorate.

Examples of a monomer which constitutes an unsaturated nitrile copolymer and is capable of copolymerizing with an unsaturated nitrile are conjugated diolefins, such as 1,3-butadiene; alkyl acrylates, such as methyl, ethyl, *n*-, *i*-propyl, and *n*-, *i*-, *t*-butyl acrylates; alkyl methacrylates, methyl, ethyl, *n*-, *i*-propyl and *n*-, *i*-, *t*-butyl methacrylates; acrylic acid, methacrylic acid, acrylamide, methacrylamide, hydroxyalkyl methacrylate, polyethylene glycol acrylate, polyethyleneglycol methacrylate, acrylamide; vinyl acetate; aromatic vinyls, such as styrene; and alkyl vinyl ethers, such as methyl vinyl ether. When, of these monomers, an aromatic vinyl is used in a large quantity, the abrasion resistance of the product disc decreases. On the other hand, monomers having a hydroxyl or an amide group such as acrylic acid, methacrylic acid, acrylamide, methacrylamide, hydroxyalkyl acrylates, hydroxyalkyl, methacrylates, polyethyleneglycol acrylates and polyethyleneglycol methacrylates are particularly preferred in view of the fact that the resulting copolymers have a higher antistatic property. The number of oxyethylene groups in the polyethylene acrylates or methacrylates recited above are preferably 23 or less, more preferably 9 or less, because the copolymers of polyethyleneglycol acrylate or methacrylate having more than 23 oxyethylene groups in the polyethyleneglycol moiety have a tendency to become white when such copolymers have absorbed moisture. The hydroxyalkyl moiety in the hydroxyalkyl acrylates and methacrylates preferably contains 1 to 8 carbon atoms, more preferably 2 to 4 carbon atoms.

The constituent resin may be a mixture of an unsaturated nitrile random copolymer and an unsaturated nitrile graft copolymer.

A preferred nitrile graft copolymer comprises from 1 to 30 parts by weight of a rubber backbone polymer and from 99 to 70 parts by weight of an unsaturated

5 nitrile polymer graft-polymerized onto the trunk polymer. A quantity of the rubber-backbone polymer in a range of preferably from 5 to 20 parts by weight, still more preferably from 10 to 15 parts by weight, affords excellent impact resistance to the product. The component of the rubber-backbone polymer comprises one or more conjugated diolefins, alkyl acrylate esters, unsaturated nitriles, alkyl methacrylates, and optionally one or more multifunctional monomers and the like copolymerizable with these monomers, wherein either or both of the conjugated diolefin or diolefins and alkyl acrylate or acrylates in which the alkyl group has from 2 to 12 carbon atoms being the principal constituent. Conventional multifunctional monomers can be used as the multifunctional monomer components.

10 The monomer mixture to be graft-polymerized preferably comprises: from 40 to 90 percent by weight, preferably from 50 to 85 percent by weight, of an unsaturated nitrile; from 7 to 60 percent by weight of at least one monomer consisting of an alkyl acrylate, (such as methyl, ethyl, *n*-, *i*-, *t*-propyl, and *n*-, *i*-, *t*-butyl-15 acrylates) alkyl methacrylates (such as methyl, ethyl, *n*-, *i*-propyl, and *n*-, *i*-, *t*-butyl-methacrylates), acrylic acid, methacrylic acid, acrylamide, methacrylamide, hydroxyalkyl acrylates (such as hydroxyethyl and hydroxypropyl acrylates), hydroxyalkyl methacrylates (such as hydroxyethyl and hydroxypropyl 20 methacrylates), polyethyleneglycol acrylates, and polyethyleneglycol methacrylates, acrylamide, vinyl acetate, and alkyl vinyl ethers (such as methyl vinyl ether); and, if desired, 40 percent or less than 40 percent by weight of a monomer which is copolymerizable with the unsaturated nitrile and is different from the above-named monomers.

25 The constituent resin of the recording discs of this invention comprises at least the unsaturated nitrile graft copolymer and may contain, additionally, a small quantity of a resin differing from the unsaturated nitrile copolymer, preferably comprising only the above-mentioned unsaturated nitrile copolymer.

30 For the constituent resin of this invention a resin is prepared by graft copolymerization of the above-mentioned resin constituents by a known polymerization process such as, for example, emulsion polymerization, suspension polymerization or solution polymerization using a radical initiator and, if necessary, a molecular weight adjuster or chain transfer agent. It is desirable that the rubber 35 particle size should be less than 0.1 micron in diameter. A graft copolymer of any number of stages of graft polymerization can be used.

35 When it is desired that the unsaturated nitrile copolymer should be a mixture of a graft copolymer and a random copolymer, the mixture preferably comprises:

40 1) 2—60 parts by weight of a graft copolymer of (a) 1—30 parts by weight of a rubber trunk polymer which is made predominantly of a conjugated diolefin or an alkyl acrylate containing 2—12 carbon atoms in the alkyl and (b) 1—30 parts by weight of a plastic component grafted onto the rubber trunk polymer, which plastic component has a composition comprising (i) 50—90% by weight of an unsaturated nitrile, (ii) 10—50% by weight of a monomer consisting of at least one alkyl acrylate and/or methacrylate having 1 to 8, preferably 1 to 4, carbon atoms in the alkyl 45 position, hydroxyalkyl acrylate or methacrylate having 1 to 8, preferably 2 to 4, carbon atoms in the alkyl position, polyethyleneglycol acrylate or methacrylate having 23 or less, preferably 9 or less oxyethylene groups, acrylamide, methacrylamide, acrylic acid, methacrylic acid, vinyl acetate or alkyl-vinylether having 1 to 4 carbon atoms in the alkyl position, and (iii) 0—10% by weight of a 50 monomer copolymerizable with the unsaturated nitrile; and (2) 40—98 parts by weight of a random copolymer of an unsaturated nitrile of the above group (i) with a monomer of the above group (ii) or (iii).

55 While the constituent resin of this invention is antistatic as it is, it is possible in some cases further to improve this antistatic property by kneading an antistatic agent thereinto or by coating the resin with the antistatic agent.

55 In addition, additives such as pigments, a mould release agent or a demoulder, a lubricant, and a processing aid can be added to the constituent resin of this invention.

60 Further specifications of the recording disc of this invention are: a Clash-Berg flex temperature of 50 to 120°C, preferably 55 to 120°C; an absorbed impact energy of at least 0.5 kg.cm., preferably 0.7 kg.cm or more, in a test specimen of a thickness of 2 mm, when subjected to a Dynastat impact test according to BS—1330—1946; and a Shore D hardness of 75 to 95, preferably 80 to 95.

65 If the above-mentioned Clash-Berg temperature exceeds 120°C, the forming characteristic of the resin will be poor. On the other hand, if this temperature is less

than 50°C, the product will be undesirable in use. Furthermore, the static characteristic of the constituent resin of this invention is, in general, greatly affected by the moisture content of the resin. That is, the greater the moisture content, the smaller is the electrostatic charge potential, and the charge readily dissipates. Accordingly, as an approximate indication of the static characteristic of the resin, its water absorption can be used, a resin of a water absorption of from 0.2 to 1.5 percent, preferably from 0.2 to 1.0 percent, being generally used. A water absorption exceeding 1.5 percent is undesirable since it gives rise to softening due to water absorption, and since stretching variation also arises because of moisture absorption.

The above enumerated physical properties of the resin are measured in the following manner. For the above-mentioned Dynstat impact test, Clash-Berg temperature measurement and Shore hardness measurement, the test pieces were pretreated for three days under the standard state of a temperature of $23 \pm 2^\circ\text{C}$ and a relative humidity of 50 ± 5 percent.

Flex temperature —

Measured by the Clash-Berg method according to ASTM D—1043 with the use of salad oil as a heat medium.

Dynstat impact test —

Carried out according to BS—1330—1946, with test pieces of 2-mm. thickness and 10-mm. width, under the standard state.

Shore hardness —

Measured according to ASTM, D2240—68, with a type D durometer, under the standard state.

Water absorption —

ASTM, D 570

The recording disc of this invention having the above-stated composition and properties can be fabricated by a known forming process.

In order to indicate more fully the nature and features of this invention, the following specific Examples of practice constituting preferred embodiments of the invention and comparison examples are set forth, it being understood that these examples are presented as illustrative only and that they are not intended to limit the scope of the invention. Throughout these examples, quantities expressed in "parts" or "percent" are by weight.

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Example 1

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This example alone does not illustrate the invention.

A 10-liter stainless-steel autoclave with agitation vanes was charged with the following materials after the aqueous solution was adjusted to a pH of 5 with an aqueous solution of sulphuric acid.

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acrylonitrile	75	parts	40
methyl acrylate	25	"	
normal-dodecylmercaptan	3.0	"	
potassium persulphate	0.04	part	
sodium bisulphite	0.01	part	
sodium dodecylbenzenesulphonate	1.0	"	45
deionized water	300	parts.	

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The air within the autoclave was thoroughly purged with nitrogen, and the above charge was agitated for 15 hours at 50°C .

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The latex thus formed was taken out of the autoclave and subjected to precipitation with an aqueous solution of aluminium sulphate. The resulting precipitate was thereafter adjusted to a pH of 7 with an aqueous solution of sodium pyrophosphate and, after dehydration and washing, was dried for 24 hours at 60°C , whereupon a white powder was obtained in a yield of 97 percent. This polymerisation process will be designated by A.

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The powder thus obtained was kneaded for 3 minutes with rolls having a surface temperature of 150°C and then press-formed at 160°C and 100 kg./cm², pressure for 2 minutes into a record disc. Various physical properties of this record disc were measured by the methods set forth in Table 1, whereupon the results shown in Table 3 were obtained. All test pieces used in the Examples and Comparison Examples were pretreated by storing for 3 days under the conditions of a temperature of 23°C and a relative humidity of 50 percent.

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In addition, heat stability was determined by placing a sheet kneaded for 3

minutes with rolls at 150°C in a Geer oven, an aging tester, at 165°, and judging by naked eye the degree of coloration of the test pieces after 30 minutes and 60 minutes, respectively.

Example 2

A 10-liter stainless-steel autoclave with agitation vanes was charged with an aqueous solution comprising the following ingredients after it was adjusted to a pH of 7 with an aqueous solution of potassium hydroxide.

5	(a)	1,3-butadiene	30	parts	
10		methyl methacrylate	17.5	parts	
		styrene	2.5	parts	10
		tertiary dodecylmercaptan	0.25	part	
		diisopropylbenzene hydroperoxide	0.1	part	
		formaldehyde sodium sulphoxylate	0.05	part	
15		ferrous sulphate heptahydrate	0.002	part	
		disodium ethylenediaminetetraacetate	0.003	part	15
		sodium pyrophosphate	0.25	part	
		sodium dodecylbenzene sulphonate	0.25	part	
		deionized water	150	parts	

The air in the autoclave was thoroughly purged with nitrogen, and the above materials were agitated at 40°C for 20 hours. As a result, a rubber latex with an average particle size of 0.07-micron diameter was obtained in yield of 99 percent.

(b) To this latex of (a) above, the following materials were added,

20		acrylonitrile	30	parts	
25		ethyl acrylate	20	parts	
		normal dodecylmercaptan	0.6	part	25
		diisopropylbenzene hydroperoxide	0.1	part	
		formaldehyde sodium sulphoxylate	0.05	part	
		sodium dodecylbenzene sulphonate	0.1	part	
		deionized water	150	parts	

The air in the autoclave was purged with nitrogen, and the resulting mixture was agitated at 40°C for 20 hours. The resulting latex was taken out of the autoclave, subjected to precipitation with an aqueous solution of aluminium sulphate, adjusted to a pH of 7 with an aqueous solution of sodium pyrophosphate, dehydrated, washed, and then dried at 55°C for 24 hours. As a result a white powder was obtained in a yield of 96 percent. This polymerization process will be designated by D.

20 parts of this white powder and 80 parts of an acrylonitrile methyl acrylate copolymer of the white powder obtained in Example 1 were mixed in powder form, and the resulting mixture was roll-pressed to form a record disc similarly to Example 1. The physical properties of the record disc were measured by the methods set forth in Table 1, whereupon the results shown in Table 3 were obtained.

Example 3.

To 40 parts of the rubber latex obtained according to Example 2 (10 parts as a rubber polymer) in the same autoclave as in Example 2, the following materials were added.

45		acrylonitrile	66	parts	
50		ethylacrylate	24	parts	
		normal dodecylmercaptan	4.5	parts	
		potassium persulphate	0.072	part	50
		sodium bisulphite	0.018	part	
		sodium dodecylbenzenesulphonate	0.82	part	
		deionized water	270	parts	

The air in the autoclave was purged with nitrogen, and the above-stated process materials were agitated at 50°C for 20 hours to effect graft copolymerisation. The resulting latex was taken out of the autoclave, subjected to precipitation with an aqueous solution of aluminium sulphate, adjusted to a pH of 7 with an aqueous

solution of sodium pyrophosphate, dehydrated, washed, and then dried at 55°C for 24 hours. As a result, a white powder was obtained in a yield of 96 percent. This polymerisation process will be designated by E.

In the same manner as in Example 1, this powder was formed into a record disc by roll pressing. The physical properties of this disc were determined by the methods set forth in Table 1, whereupon the results shown in Table 3 were obtained.

Examples 4 to 7.

The polymers and mixtures of polymers of the compositions set forth in Table 2 were polymerised in accordance with the indicated polymerisation process from amongst the processes of Examples 1 to 3, and each of the resulting resins was formed into a record disc similarly to Example 1. The physical properties of these discs were measured by the methods set forth in Table 1, whereupon the results shown in Table 3 were obtained.

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Comparison Example 1.

A mixture of 100 parts of a vinyl chloride-vinyl acetate copolymer resin (average degree of polymerisation approximately 450, vinyl acetate content approximately 15 percent) for record discs, 0.8 part of a quaternary ammonium salt antistatic agent, 1 part of dibutyl tin dilaurate and 0.5 part of carbon black were formed similarly to Example 1. The results of measurements of the physical properties of the resulting product are shown in Table 3 below.

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Comparison Example 2.

A mixture of 70 parts of a vinyl chloride-vinyl acetate copolymer resin (average degree of polymerisation approximately 500, vinyl acetate content approximately 15 percent) for record discs, 30 parts of a vinyl chloride resin (average degree of polymerisation approximately 700), 0.8 part of a quaternary ammonium salt antistatic agent, 1 part of a dibutyl tin dilaurate and 0.2 part of carbon black were formed similarly to Example 1. The results of measurements of the physical properties of the resulting product are set forth in Table 3.

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Comparison Example 3.

The procedure of Comparison Example 2 was carried out except that the antistatic agent was not used, whereupon the results shown in Table 3 were obtained.

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Table 1.
Physical properties and measurement thereof

Physical Property	Measurement method and conditions
Hardness	Shore hardness tester (mfd. by Toyo Seiki), type D durometer, according to ASTM D 2240—68, 23°C, 50% RH.
Impact resistance	Dynstat impact testing machine, according to BS 1330—1946, 23°C, 50% RH, test specimen 10-mm width, 2-mm, thickness.
Tensile strength (Yield point)	Cross Head speed 10% of specimen length/min., 23°C, 50% RH.
Abrasion resistance	Taber abrader (manufactured by Nippon Rigaku Kogyo), standard abrasion wheel CS—10 (manufactured by Teledyne Co., U.S.A), load 500 grams, abrasion indicated as abrasion quantity per 1,000 revolutions (g/1,000 r.), 23°C, 50% RH.
Flex temperature	Clash-Berg method specified in Japanese Industrial Standards JIS K—6745, (with salad oil as heat medium).
Fluidity	Kohka type flow tester (Kohka is a Trade Mark), nozzle 1-mm. diam. x 10 mm, load 100 kg/cm ² , temperature rise rate 3°C/min, fluidity expressed as temperature (°C) at which apparent viscosity is 10 ⁵ poise.
Frictional static characteristic	Kyoto University Chem. Res. Inst. type rotary static tester, 430 rpm., indication as electrostatic charge potential (V) after 1 min. of frictional rubbing, 23°C., 50% RH.
Auditory sensation	Tested under the conditions of reproduction with a diamond stylus with a tip radius of 0.18 ± 0.003 mm. applied with a stylus force of 2.g.

TABLE 2
Compositions of record discs of this invention (units: parts by weight)

Example	Unsaturated nitrile random copolymer constituents				Polymerization process	Unsaturated nitrile graft copolymer				Graft monomer		
	Polymerization on process	AN	MA	BA		But	BA	MMA	ST	1,3BD	AN	EA
1	A	75	25									
2	A	60	20	D								
3				E	6							
4	A	45	15	D	12							
5	A	48	32	D	6							
6	A	56	16	8	D	6						
7	A	60	20	D		10						

Abbreviations used in Table 2

- AN : acrylonitrile
- MA : methyl acrylate
- EA : ethyl acrylate
- BA : butyl acrylate
- ST : styrene
- MMA : methyl methacrylate
- But : butadiene
- 1,3 BD : 1,3-butenediol diacrylate

TABLE 3
Properties of record discs of this invention and of comparison examples

Coloration due to heat stability aging test						Abrasion quantity by Taber Abrasion test (mg/1000M cycles)				Frictional static potential (V)		Auditory sensation	
	After 30 min.	After 60 min.	Hardness	resistance (kg.cm)	Tensile strength (kg/cm ²)	Flex. temp. (°C)	Fluidity (°C)						
Example 1	colorless	light yellow	95	1.3	790	18	74	158	660	High tones	good		
,	2	,	90	2.4	650	21	72	160	640	,	,		
,	3	,	90	3.1	580	24	60	156	610	,	,		
,	4	,	85	4.5	570	24	68	163	560	High tones	fair		
,	5	,	85	2.8	570	25	58	153	400	,	,		
,	6	,	85	2.5	550	24	60	155	440				
,	7	,	90	2.3	570	24	58	155	570	High tones	good		
Comparison example 1	yellow	black brown	75	1.0	450	28	50	149	1040	Standard			
,	2	,	,	75	1.2	510	25	55	167	1420	,		
,	3	,	,	75	1.2	510	25	55	167	2200	much noise		

As is apparent also from the foregoing description with respect to the Examples and Comparison Examples, the resin record disc of this invention possesses the following advantageous features, which could not be attained in the record disc resin compositions used or proposed heretofore such as those of vinyl chloride resins, polystyrene, and polyacrylic resins.

- 1). The record disc of this invention is of antistatic character. Any dust settling on this record can be removed simply by blowing with the mouth, and there is no necessity of using a cleaner as heretofore. 5
- 2). The resin is homogeneous since there is no necessity of using additives and since the resin is amorphous, whereby there is no deleterious effect on the tone quality of the reproduced sound. Since the resin is also optically uniform, isotropic, and transparent, a product of high performance can be obtained even in the case of a video disc for optical detection. 5
- 3). A vinyl chloride-vinyl acetate copolymer has poor heat stability. For this reason, its forming temperature cannot be made high, and it must be formed with a low degree of polymerization. As a consequence, its various properties such as impact resistance and wear resistance are adversely affected. In contrast, the constituent resin of this invention has good heat stability. Accordingly, a high forming temperature can be used to increase its fluidity, and since a resin of a higher degree of polymerization can be used, its various properties can be removed. 10
- 4). Record discs in which polystyrene resins or polymethacrylate resins are used have certain properties which are poor and therefore cannot be practically used in a wide range of applications. In contrast, the various properties of the record disc of this invention can be adjusted as desired by suitable choice of the kind and quantity of the monomers. Accordingly, record discs, in which a good balance of several properties is required, can be made to have a high performance. 20
- For example, by causing the flex of Clash-Berg temperature to be high, warping and waviness due to heat can be prevented, and shortening of the forming cycle can be attained. At the same time, the impact resistance, wear resistance and formability are good. 25
- 5). By increasing the hardness of the record disc, the high frequency characteristic thereof can be improved. For example, the high frequency characteristic can be thus improved, with almost no variation of the phonograph and reproducing system used at present, by so choosing the monomers within the scope of this invention that the Shore hardness will be from 80 to 95 at 25°C and 50 percent relative humidity with a type D durometer indentor according to ASTM D2240—68. At the same time, other good properties such as the heat stability and formability of the resin are also obtained. 30
- Furthermore, as measured by the method specified in Table 1, the flow starting point of the resin of this invention is from 110 to 150°C, and the fluidity is from 140 to 170°C. Thus, this resin exhibits a fluidity characteristic which is substantially the same as that of a vinyl chloride-vinyl acetate copolymer. Accordingly, a further advantageous feature of the record disc of this invention is that it can be formed by means of a conventional record disc forming apparatus as it is. 35
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WHAT WE CLAIM IS:—

1. An information signal recording disc comprising a constituent resin comprising at least one unsaturated nitrile graft copolymer and having therein an unsaturated nitrile content of from 40 to 90 percent by weight, said disc exhibiting a Clash-Berg flex temperature of from 50 to 120°C, an absorbed impact energy of at least 0.5 kg.cm. when tested with a test specimen thereof of a 2-mm. thickness by a Dynstat impact test according to British Standard (BS)—1330—1946, and a Shore D hardness of from 75 to 95. 45
2. An information signal recording disc as claimed in claim 1, in which the unsaturated nitrile graft copolymer has been formed by graft-polymerising an unsaturated nitrile onto a rubber-backbone polymer. 50
3. An information signal recording disc as claimed in claim 1 or 2, in which the unsaturated nitrile content of the constituent resin is from 50 to 85 percent by weight. 55
4. An information signal recording disc as claimed in any of claims 1 to 3, in which, within the constitutive unit of the unsaturated nitrile copolymer, the principal constituent other than the unsaturated nitrile comprises at least one monomer consisting of at least one conjugated diolefin, alkyl acrylate, alkyl methacrylate, acrylic acid, methacrylic acid, acrylamide, methacrylamide, hydroxyalkyl methacrylate, polyethylene glycol acrylate, polyethyleneglycol methacrylate, acrylamide, vinyl acetate or alkyl-vinylether. 60
5. An information signal recording disc as claimed in any of claims 1 to 4, in which the constituent resin is a mixture of an unsaturated nitrile random

copolymer and an unsaturated nitrile graft copolymer.

6. An information signal recording disc as claimed in claim 5, in which the constitutive unit of the random copolymer comprises from 40 to 90 percent of the unsaturated nitrile, from 1 to 30 percent of a conjugated diolefin, and from 0 to 59 percent of a monomer copolymerisable with the unsaturated nitrile, all quantities in percent being by weight.

7. An information signal recording disc as claimed in any of claims 1 to 6, in which the unsaturated nitrile graft copolymer is formed by graft polymerizing from 99 to 70 parts of a monomer mixture comprising from 40 to 90 percent of the unsaturated nitrile and from 10 to 60 percent of a monomer copolymerizable with the unsaturated nitrile onto from 1 to 30 parts of a rubber-backbone polymer, all quantities in percent and parts being by weight.

8. An information signal recording disc as claimed in claim 7, in which the constitutive unit of the rubber-backbone polymer has a conjugated diolefin as the principal constituent thereof.

9. An information signal recording disc as claimed in claim 7, in which the constitutive unit of the rubber-backbone polymer has an alkyl acrylate as the principal constituent thereof.

10. An information signal recording disc as claimed in claim 5, in which the mixture of a random copolymer and a graft copolymer comprises:

1) 2—60 parts by weight of a graft copolymer of (a) 1—30 parts by weight of a rubber backbone polymer which is made predominantly of a conjugated diolefin or an alkyl acrylate containing 2—12 carbon atoms in the alkyl and (b) 1—30 parts by weight of a plastic component grafted onto the rubber trunk polymer, which plastic component has a composition comprising (i) 50—90% by weight of an unsaturated nitrile, (ii) 10—50% by weight of a monomer consisting of alkyl acrylates or methacrylates having 1 to 8, preferably 1 to 4, carbon atoms in the alkyl; hydroxyalkyl acrylates or methacrylates having 1 to 8, preferably 2 to 4, carbon atoms in the alkyl, polyethylene glycol acrylates or methacrylates having 23 or less, preferably 9 or less oxyethylene groups, acrylamide, methacrylamide, acrylic acid, methacrylic acid, vinyl acetate or alkylvinylethers having 1 to 4 carbon atoms in the alkyl position, and (iii) 0—10% by weight of a monomer copolymerizable with the unsaturated nitrile, and (2) 40—98 parts by weight of a random copolymer of an unsaturated nitrile chosen from the above group of (i) and a monomer chosen from the above groups (ii) and (iii).

11. An information signal recording disc as claimed in any of claims 1 to 10, in which the unsaturated nitrile consists of acrylonitrile, methacrylonitrile, or a mixture thereof.

12. An information signal recording disc as claimed in claim 1, substantially as herein described with reference to any of the specific examples 2 to 7.

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