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POLYTETRAFLUOROETHYLENE COATING COMPOSITIONS

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This invention relates to liquid polytetrafluoroethylene coating compositions and more particularly to liquid polytetrafluoroethylene coating compositions which yield relatively thick crack-free films.

A customary and convenient form of liquid polytetrafluoroethylene coating composition is a dispersion of colloidal polytetrafluoroethylene in water as disclosed in U. S. Patent 2,478,229 to Berry and U. S. Patent 2,534,058 to Renfrew.

It has long been known that polytetrafluoroethylene films which are deposited on a substrate by a single application of an aqueous suspension of polytetrafluoroethylene tend to develop cracks during the drying and baking steps when the dry film thickness exceeds the order of 1 to 2.5 mils depending upon the particular lot of aqueous polytetrafluoroethylene suspensoid used. Each different lot of suspensoid possesses its own "critical cracking thickness" value which is the dry film thickness above which objectionable cracks develop during drying and/or fusing. The cracks formed during drying of the polytetrafluoroethylene aqueous suspensoid vary in size from unmagnified visual cracks to microscopic cracks. This cracking tends to develop not only in films of uniform thickness greater than about 1 to 2.5 mils but also where such a film thickness occurs accidentally because of poor control in application or because of the shape of the object being coated. For instance, a smooth steel panel coated with a particular sample of an aqueous polytetrafluoroethylene suspension at a dry film thickness of 1.5 mils over most of the panel area might be free of cracks except for narrow areas along the periphery where a fatty edge or bead had formed. Such a bead might be 2–3 mils thick, resulting from a normal accumulation of excess coating material along the edges of the article being coated by conventional means. Cracks in a polytetrafluoroethylene coating could also be expected on the convex or "high" areas of an irregularly shaped article. This phenomenon is illustrated in applying a coating of an aqueous suspension of polytetrafluoroethylene to the mold surfaces of a muffin tin. In attempting to apply a uniform 1 mil coating on the indented mold surfaces, a considerable thickness of polytetrafluoroethylene is accidentally built up on the upper edge or rim of each muffin mold. When

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heated, to dry and fuse, the coating develops cracks at this point. Such cracks not only adversely affect the appearance of the article but they lead to premature failure of the coating.

For certain purposes, particularly in corrosion resistant service on metals, it is necessary or desirable to have polytetrafluoroethylene films more than 2.5 mils thick and sometimes even as high as 5 to 15 mils thick. Under very closely controlled conditions, relatively thick polytetrafluoroethylene films can be built up on a substrate by applying several consecutive thin coats of an aqueous suspension, i. e. of the order of 1 mil each, followed by a separate baking or fusing operation after each coat. It is obvious however that this method is laborious, cumbersome and costly; and furthermore it does not eliminate the need for extreme care in avoiding heavy beads or fatty edges.

U. S. Patent 2,539,329 which issued January 23, 1951, to P. F. Sanders discloses a mechanical method of eliminating cracks in polytetrafluoroethylene coatings applied from an aqueous suspension to inorganic fabrics, such as, e. g. woven glass fabrics, but it is obvious that such a process is not practical for irregularly shaped rigid articles, such as the above mentioned muffin tin.

The principal object of this invention is to increase the "critical cracking thickness" of a film deposited from a single coat of an aqueous polytetrafluoroethylene coating composition.

Another object of this invention is to provide modified aqueous polytetrafluoroethylene coating compositions which yield in one coat crack-free films substantially thicker than those obtainable with polytetrafluoroethylene alone in one coat.

A further object is to provide liquid polytetrafluoroethylene coating compositions which do not crack when applied at dry film thicknesses above the order of 1 to 2.5 mils, this thickness being representative of dry film thickness at which films of polytetrafluoroethylene alone can be expected to crack.

A still further object is to provide a liquid polytetrafluoroethylene coating composition which can be applied to a substrate in one coat to yield a dry crack-free protective coating which is substantially thicker than the thickest dry crack-free film capable of being produced by a par-

ticular aqueous polytetrafluoroethylene suspension, the "critical cracking thickness" of which is to be improved.

Another object is to provide articles coated with thick crack-free polytetrafluoroethylene coatings.

These objects are accomplished by incorporating into an aqueous dispersion of colloidal polytetrafluoroethylene a substantial amount of a modifying polymeric material other than polytetrafluoroethylene in the form of discrete particles suspended in a liquid medium comprising a preponderant amount of water, and/or solvent-swollen particles dispersed in a liquid medium comprising a substantial proportion of water and/or globules of an organic solution dispersed in a liquid medium comprising a substantial proportion of water. The modifying polymeric material in said form must be co-dispersible and compatible with the polytetrafluoroethylene aqueous suspension and stable for a sufficiently long period of time when admixed with the polytetrafluoroethylene suspension to be commercially useful. The modifying polymeric material in said form must also be capable alone of yielding in one coat a crank-free film thicker than the thickest one coat film capable of being produced by the aqueous polytetrafluoroethylene suspension alone, when said modifying polymeric material is baked at the fusion or coalescing temperature of the admixture of the polytetrafluoroethylene and the modifying polymeric material.

The mixed dispersion of polytetrafluoroethylene and other polymeric material is referred to hereinafter as a "codispersion." The modifying polymeric material which is admixed with the polytetrafluoroethylene dispersion is referred to hereinafter as "polymeric material" or "codispersed polymeric material" or "codispersed material." The term "critical cracking thickness" as used throughout the specification and claims means the dry film thickness above which cracks develop in a film deposited from one coat of an aqueous dispersion of polytetrafluoroethylene. Throughout the specification and claims the terms "dispersion" and "suspension" are used synonymously to denote a composition which contains discrete particles comprising polymeric material distributed uniformly throughout a liquid medium. The term "crack" means a linear rupture or fissure which extends from the outer surface of a film partially or completely through the film to the substrate beneath, such fissure being at least large enough to be visible to the naked eye or when magnified one hundred times under good illumination. The terms "crack-free" and "free of cracks" mean that the film in question contains an average of not more than one of the above defined cracks for each 100 sq. centimeters of film surface area.

The method of determining whether a polymeric material is capable of forming a crack-free film in one coat as defined above, having the thickness required of the ultimate polytetrafluoroethylene coating, consists of (1) applying to a smooth rigid substrate, such as a clean 4" by 4" glass panel, by spraying, dipping or other suitable method, enough of a liquid coating composition containing the polymer in question to yield a dry film of the desired thickness, (2) drying the film at about 100° C. until substantially all of the volatile component has evaporated, (3) baking or fusing at the required temperature and (4) examining the coating by the naked eye, or under magnification if necessary, to determine the presence or absence of cracks as defined above.

The following detailed description is given by way of illustration and not of limitation. The parts and percentages are on a weight basis.

EXAMPLE 1

A relatively concentrated aqueous suspensoid of polytetrafluoroethylene having the following composition was used:

	Per cent
Colloidal polytetrafluoroethylene	60.0
Wetting agent	0.6
Water	39.4
	100.0

This aqueous suspensoid had been prepared by the methods disclosed in Renfrew U. S. Patent 2,534,058 which issued December 12, 1950, and Berry U. S. Patent 2,478,229 which issued August 9, 1949.

The wetting agent was the sodium salt of the sulfuric acid ester of a mixture of long chain alcohols, predominantly lauryl alcohol. Other suitable wetting agents may be substituted in quantities sufficient to stabilize the dispersion. Aqueous suspensoids containing different concentrations of polytetrafluoroethylene may be substituted for the 60% suspensoid on the basis of equivalent polytetrafluoroethylene content. Concentrations between about 5% and 75% are useful. The 60% material was used largely for its convenience of handling and its high solids content which is conducive to thicker dry films than lower solids dispersions.

To 150 parts of this aqueous polytetrafluoroethylene suspensoid were slowly added 21 parts of "Rhoplex" MR aqueous suspension of polymeric lower alkyl acrylate (47.6% solids) with moderate agitation. Agitation was continued for about 5 minutes to assure uniformity. One face of clean 4" by 4" steel panel was sprayed with a heavy coat of the resulting codispersion. The panel was force dried for 10 minutes at about 212° F. and then baked for 5 minutes at 750° F. The force drying step was employed only to drive off the water before rusting of the steel could take place. If an inert substrate, such as glass, had been used, the water in the film could have been substantially removed by a longer drying period at room temperature. This pre-drying step provides a factor of safety in eliminating the possibility of rough or blistered films which might result from the rapid volatilization of large quantities of water at high baking temperatures.

The dry coating of codispersion on the steel panel was measured and found to be 4.5 mils thick. It was smooth and crack-free. Comparative coatings derived from the aqueous polytetrafluoroethylene suspensoid alone were smooth and crack-free at 1 mil dry film thickness, sparsely populated with small cracks at 2 mils, and more densely populated with relatively large cracks at 3 mils. The "critical cracking thickness" for this particular lot of polytetrafluoroethylene aqueous suspensoid was 1.8 mils.

These results show that films derived from an aqueous codispersion of "Rhoplex" MR and polytetrafluoroethylene are crack-free at greater thicknesses than the polytetrafluoroethylene alone. In investigating the reason for this improvement, "Rhoplex" MR films were prepared by the methods previously described. It was de-

termined that the "Rhoplex" MR alone formed crack-free films up to 4.5 mils thick.

"Rhoplex" MR was tested at different concentrations and other aqueous polymeric dispersions were blended with aqueous polytetrafluoroethylene suspension and tested as described in the above example. The results are recorded as Examples 1 through 31 in the following Table I. For convenience in making direct comparisons, the same lot of polytetrafluoroethylene dispersion was used in all examples. Since it had a "critical cracking thickness" of 1.8 mils, an arbitrary value of 2 mils (approximately 10% improvement) was established as the minimum film thickness for acceptable codispersed polymeric material and codispersions thereof with this particular lot of polytetrafluoroethylene .

to be 21 to 150; Example 2, 69 to 109; Example 3, 52 to 125; Example 4, 13 to 157, etc. In Examples 17, 20 and 27, the organic solvent may be added to either or both aqueous dispersions before they are combined or to the combined dispersions.

It is obvious from the results recorded above that this invention is not defined by the chemical constituents of the codispersed polymeric material. For instance, Examples 13, 14 and 15 are all based on styrene/butadiene copolymer latices but Example 14 is inoperable within the spirit and scope of this invention. Examples 18 and 19 are both based on butadiene/acrylonitrile copolymer latices but Example 19 is inoperable. Examples 23 and 24 are both based on polyvinyl acetate latices but Example 23 is inoperable. Examples 28 and 29 are both based on polyamide

Table I

CRACKING PROPERTIES OF FILMS

Example	Aqueous Polymeric Dispersion					Aqueous Polytetra-fluoroethylene Dispersion		Parts Added Solvent	Codispersion	
	Name	Polymeric Constituents	Parts Polymer	Parts Dispersing Medium	Forms Crack-free Film-2 Mils or Thicker	Parts Polytetrafluoroethylene	Parts Dispersing Medium		Forms Crack-free Films 2 Mils or Thicker	Dry Film Thickness-Mils [1]
1	"Rhoplex"[2] MR	Alkyl Acrylate	10	11	Yes	90	60		Yes	4.5
2	do	do	33	36	Yes	67	42		Yes	10
3	do	do	25	27	Yes	75	50		Yes	5.4
4	"Rhoplex"[2] FRN	do	5	8	Yes	95	62		Yes	5.5
5	do	do	28	42	Yes	72	48		Yes	9.5
6	"Rhoplex"[2] WC9	do	5	8	Yes	95	62		Yes	4.2
7	do	do	28	43	Yes	72	48		Yes	13.7
8	"Rhoplex"[2] WN75	do	28	42	Yes	72	48		Yes	5
9	"Rhoplex"[2] ER	do	33	34	Yes	67	45		Yes	5
10	"Rhoplex"[2] WN80	do	38	42	Yes	72	48		Yes	5
11	Polybutyl acrylate	Butyl Acrylate	22	34	Yes	78	52		Yes	10
12	"Methacrol"[3] LB	Butyl Methacrylate	22	46	Yes	78	52		Yes	10
13	Dow Latex 512K [4]	Styrene/butadiene	32	39	Yes	68	45		Yes	10
14	"Pliolite" [5] Latex 190	do	23	55	No	77	51		Yes	10
15	"Lotol" [6] 5229	do	20	25	Yes	80	53		No	<2
16	Bakelite BKS92 [7]	Styrene	18	26	No	82	55		Yes	7.5
17	do	do	18	26	No	82	55		No	<2
18	"Nitrex" [8] 2612	Butadiene/acrylonitrile	22	35	Yes	78	52	44 xylene	Yes	5
19	"Hycar" [9] Latex 2507	do	16	26	No	84	56		Yes	13
20	do	do	16	26	No	84	56		No	<2
21	Polyacrylonitrile	Acrylonitrile	28	42	No	72	48	4 toluene	Yes	2
22	Polymethacrylonitrile	Methacrylonitrile	19	67	No	81	54		No	<2
23	"Elvacet" [10] 81-900	Vinyl acetate	33	27	No	67	45		No	<2
24	"Elvacet" 83-1200	do	23	19	Yes	77	51		No	<2
25	"Geon"[11] Latex 31X	Modified vinyl chloride	22	57	Yes	78	52		Yes	2
26	Dow Latex 744 [12]	Vinyl chloride/vinylidene chloride.	22	22	No	78	52		Yes	2
27	do	do	22	22	No	78	52		No	<2
28	Polyamide A-000 [13]	Amine-acid condensate	22	22	No	78	52	44 methyl isobutylketone	Yes	3.5
29	Polyamide B-200 [14]	do	22	22	Yes	78	52		No	<2
30	Polythene Sulfonamide	Sulfonamide of polyethylene.	29	40	No	71	47		Yes	5
31	Polythene	Ethylene	35	140	No	65	43		No	<2

[1] The dry crack-free films measured are not necessarily the thickest crack-free films capable of being deposited from the given codispersion.

[2] "Rhoplex" is a trade name used by Rohm & Haas Company for aqueous dispersions of what are understood to be polymeric lower alkyl acrylates containing less than 5 carbon atoms in the alkyl group, such as ethyl acrylate, or blends thereof.

[3] "Methacrol" LB is a trade name for aqueous dispersions of polybutyl methacrylate.

[4] Dow Latex 512K is used by Dow Chemical Company to designate an aqueous dispersion of what is understood to be a copolymer of butadiene and styrene.

[5] "Pliolite" is a trade name used by the Goodyear Tire & Rubber Company for aqueous dispersions of rubbery copolymers, such as styrene/butadiene.

[6] "Lotol" is a trade name used by the Naugatuck Chemical Division, United States Rubber Company for aqueous dispersions of what are understood to be copolymers of styrene and butadiene.

[7] Bakelite BKS92 is used by the Bakelite Division, Union Carbide & Carbon Corporation to designate an aqueous dispersion of what is understood to be polystyrene.

[8] "Nitrex" is a trade name used by the Naugatuck Chemical Division, United States Rubber Company for aqueous dispersions of what are understood to be copolymers of butadiene and acrylonitrile.

[9] "Hycar" is a trade name used by B. F. Goodrich Chemical Co. for rubbery copolymers of butadiene and acrylonitrile.

[10] "Elvacet" is a trade name for aqueous dispersions of polyvinyl acetate.

[11] "Geon" is a trade name used by B. F. Goodrich Chemical Company for vinyl chloride polymers and copolymers.

[12] Dow Latex 744 is used by Dow Chemical Company to designate an aqueous dispersion of what is understood to be a copolymer of vinyl chloride and vinylidene chloride.

[13] Polamide A-000 is a trade name used by General Mills, Inc., for aqueous dispersions prepared by the condensation of dimerized vegetable oil acids and ethylene diamine. The suspension is fortified with small amounts of modifying resin.

[14] Polyamide B-200 is a trade name used by General Mills, Inc., for an aqueous dispersion of a condensation polymer derived from ethylene diamine and dimeric vegetable oil acids which has been further compounded after dispersion to improve adhesive characteristics.

In the above table the ratio of the aqueous polymeric dispersion to the aqueous polytetrafluoroethylene dispersion is shown for Example 1 latices, but Example 23 is inoperable.

Furthermore the results recorded in Table I show that, if a polymeric dispersion does not it-

self form a crack-free film as defined, the codispersion with polytetrafluoroethylene does not yield such a film. Examples 14, 16, 19, 21, 22, 23, 26, 28, 30 and 31 show this result. However Examples 17, 20 and 27 show that, if a polymeric dispersion which does not itself form a crack-free film above the critical cracking thickness of the polytetrafluoroethylene, as defined, is modified to make it form such a film, a similarly modified codispersion of the same polymeric material with polytetrafluoroethylene does form a crack-free film.

EXAMPLE 32

An aqueous suspensoid of polytetrafluoroethylene having the following composition was used:

	Parts
Colloidal polytetrafluoroethylene	50.0
Wetting agent	0.5
Water	49.5
	100.0

This suspensoid differed from the polytetrafluoroethylene suspensoid used in Example 1 only in the concentrations of polytetrafluoroethylene and wetting agent.

To 100 parts of the above suspensoid were added 10.5 parts of "Rhoplex" ER (footnote 2, Table I) with moderate agitation. Mixing was continued until the codispersion was uniform.

Two swatches of woven glass fabric were cut from a roll of Owens-Corning Fiberglas #ECC–108, as described on page 28 of the Owens-Corning Fiberglas Corporation catalog entitled "Manual and Catalog of Fiberglas." The ECC–108 Fiberglas had a thickness of 2 mils.

One swatch was coated with the above codispersion by applying two separate coats by dipping, each coat being followed by force drying at 310°–330° F. After the second force drying step the assembly was heated at 750° F. for about 5 minutes to fuse or sinter the coating. The resulting coated fabric had a thickness of about 4.5 mils and showed no cracks.

The other swatch was coated by the same process with two coats of the polytetrafluoroethylene aqueous suspensoid, without "Rhoplex" ER. The resulting coated fabric was characterized by the presence of mud-cracks as described in Sanders U. S. Patent 2,539,329 which issued January 23, 1951.

These results show that crack-free modified polytetrafluoroethylene coated fabrics can be made by a simple coating and fusing process which eliminates the calendering step described in Sanders U. S. Patent 2,539,329.

Additional tests on the coatings derived from the operable examples of the codispersions show that the crack-free coatings also possess the desirable properties of coatings derived from polytetrafluoroethylene alone, namely, good electrical properties, chemical and solvent resistance, corrosion resistance, and resistance to the adhesion or sticking of extrinsic substances applied thereto.

In order to define the invention, attempts were made to distinguish the operable polymers from the inoperable ones by such properties as their chemical composition, molecular weight, melting or fusing point, viscosity, solubility, particle size, and physical form or state. A cataloging of such properties provided no line of distinction by which the operable polymers could be distinguished from the inoperable ones. The only method for accomplishing this is to employ the physical procedure of determining whether the polymeric dispersion in question by itself forms a crack-free film of the necessary thickness as defined above.

Thus it is seen that the problem of the cracking of polytetrafluoroethylene coatings deposited from aqueous dispersions which heretofore has restricted or prevented the full utilization of polytetrafluoroethylene finishes, has been solved in an unexpected way by modifying the aqueous dispersion of polytetrafluoroethylene with another chemically dissimilar polymeric dispersion possessing the property of forming crack-free films in one coat above the critical cracking thickness of the particular lot of polytetrafluoroethylene to be modified.

In the examples the ratio of codispersed polymer to polytetrafluoroethylene ranges between 5/95 and 33/67. It is to be emphasized that these ratios are merely illustrative. Since the many operable codispersed materials possess desirable properties to different degrees, it is obvious that when all are separately codispersed with polytetrafluoroethylene in exactly the same ratio, the resulting codispersions do not have the same properties. For example, although 5% of one codispersed polymeric material may be sufficient to produce acceptable results, 10% of a different codispersed polymeric material may be required to provide equivalent results at the same film thickness under the same conditions. Since the coating compositions of the invention are designed for a variety of uses which require different film thicknesses, the minimum amount of any operable codispersed material to be compounded with polytetrafluoroethylene is that amount which is sufficient to produce a crack-free coating having a film thickness greater than the critical cracking thickness of the polytetrafluoroethylene to be modified. The optimum amount of any operable codispersed material to be compounded with polytetrafluoroethylene is that amount beyond which no additional advantage is obtained at the film thickness required for the use to which it is to be put.

In the examples a single baking schedule was used, namely, 5 minutes at 750° F., largely as a matter of convenience to eliminate the baking variable which might result in differences in performance of the coatings. The particular length of time and the particular temperature form no part of this invention and are not critical. The time and temperature, in combination, may be varied over wide ranges from the minimum combination required to produce the desired film up to the maximum beyond which decomposition, charring, or other deleterious effects are produced.

In Examples 1–31, the test panels are coated by spraying. Other well-known methods of application may be employed such as, for instance, dipping, flowing (pouring and draining) and electrodeposition.

In the examples the codispersions consist of an aqueous dispersion of polytetrafluoroethylene and one other aqueous dispersion of polymeric material. The invention is not limited thereto, as it is obvious that polytetrafluoroethylene dispersion may be modified with more than one other dispersion and/or a dispersion containing two or more distinct polymeric or copolymeric materials, provided of course that the codispersed

materials have the previously defined physical properties.

The polytetrafluoroethylene dispersion and/or the codispersed material may contain modifying agents, such as pigments, dyes, soluble chemical substances, inhibitors, dispersing agents, and other modifiers well-known in the coating composition art, to color, stabilize or otherwise modify the chemical or physical properties of the codispersions or the films derived therefrom, provided any such modifying agent employed is innocuous to the composition and its components.

The products of this invention are particularly useful in coating heat resistant surfaces, such as, metals, ceramics, glass fabrics, asbestos fabrics, woven wire fabrics, heat treated polyacrylonitrile fabrics such as disclosed in copending application S. N. 706,515, filed October 29, 1946, by C. R. Humphreys. The coating compositions of this invention are also useful for coating substrates which have a decomposition temperature below the fusion temperature of polytetrafluoroethylene, such as, cotton, nylon, rayon, and various synthetic resins, in which case the baking temperature must be below the fusion temperature of the substrate.

Specific uses for the products of this invention include anti-sticking coatings for muffin tins or cookie sheets, electrically insulating coatings for wire, spark-plugs, condensers and corrosion resistant interior coatings for metal tanks containing corrosive chemical materials.

Although the invention permits polytetrafluoroethylene to be used in film thicknesses commonly employed in the paint, varnish, enamel, coated fabric, and unsupported sheeting industries, it is not to be understood as providing articles or coatings so thick that they are not normally useful in one of the aforementioned industries.

It is apparent that many widely different embodiments of this invention can be made without departing from the spirit and scope thereof and, therefore, it is not intended to be limited except as defined in the appended claims.

I claim:

1. A liquid coating composition which comprises an aqueous dispersion of polytetrafluoroethylene containing a wetting agent and an aqueous dispersion of another polymeric material selected from the class consisting of polymeric alkyl acrylates in which the alkyl group contains less than 5 carbon atoms, polybutyl methacrylate, copolymers of styrene and butadiene, polystyrene, copolymers of butadiene and acrylonitrile, and copolymers of vinyl chloride and vinylidene chloride, the said second mentioned aqueous dispersion of polymeric material and said coating composition each having the property of drying at a temperature of at least 100° C. in one coat to a crack-free film having a thickness greater than the critical cracking thickness of said aqueous dispersion of polytetrafluoroethylene alone.

2. A liquid coating composition comprising an aqueous dispersion of polytetrafluoroethylene containing a wetting agent and an aqueous dispersion of a polymeric alkyl acrylate in which the alkyl group contains less than 5 carbon atoms, the second mentioned aqueous dispersion and said coating composition each having the property of drying at a temperature of at least 100° C. in one coat to a crack-free film having a thickness greater than the critical cracking thickness of said aqueous dispersion of polytetrafluoroethylene alone.

3. A liquid coating composition comprising an aqueous dispersion of polytetrafluoroethylene containing a wetting agent and an aqueous dispersion of a copolymer of butadiene and acrylonitrile, the second mentioned aqueous dispersion and said coating composition each having the property of drying at a temperature of at least 100° C. in one coat to a crack-free film having a thickness greater than the critical cracking thickness of said aqueous dispersion of polytetrafluoroethylene alone.

4. A liquid coating composition comprising an aqueous dispersion of polytetrafluoroethylene containing a wetting agent and an aqueous dispersion of a polybutyl methacrylate, the second mentioned aqueous dispersion and said coating composition having the property of drying each at a temperature of at least 100° C. in one coat to a crack-free film having a thickness greater than the critical cracking thickness of said aqueous dispersion of polytetrafluoroethylene alone.

5. A liquid coating composition comprising an aqueous dispersion of polytetrafluoroethylene containing a wetting agent and an aqueous dispersion of a polyvinyl acetate, the second mentioned aqueous dispersion and said coating composition each having the property of drying at a temperature of at least 100° C. in one coat to a crack-free film having a thickness greater than the critical cracking thickness of said aqueous dispersion of polytetrafluoroethylene alone.

6. A liquid coating composition comprising an aqueous dispersion of polytetrafluoroethylene containing a wetting agent and an aqueous dispersion of a copolymer of butadiene and styrene, the second mentioned aqueous dispersion and said coating composition each having the property of drying at a temperature of at least 100° C. in one coat to a crack-free film having a thickness greater than the critical cracking thickness of said aqueous dispersion of said polytetrafluoroethylene alone.

7. An article coated with a dry crack-free coating of the composition of claim 10.

8. A rigid article coated with a dry crack-free coating of the composition of claim 10.

9. A flexible substrate coated with a dry crack-free coating of the composition of claim 10.

10. A liquid coating composition comprising an aqueous dispersion of polytetrafluoroethylene containing a wetting agent and an aqueous dispersion of another resinous polymerized ethylenically unsaturated material, the second mentioned aqueous dispersion and said coating composition each having the property of drying at a temperature of at least 100° C. in one coat to a crack-free film having a thickness greater than the critical cracking thickness of said aqueous dispersion of polytetrafluoroethylene alone.

11. The method of increasing the critical cracking thickness of an aqueous polytetrafluoroethylene coating composition which comprises incorporating in an aqueous dispersion of polytetrafluoroethylene containing a wetting agent a compatible aqueous dispersion of another resinous polymerized ethylenically unsaturated material, the second mentioned aqueous dispersion and said coating composition each having the property of drying at a temperature of at least 100° C. in one coat to a crack-free film having a thickness greater than the critical cracking thickness of said aqueous dispersion of polytetrafluoroethylene alone.

12. The method of producing crack-free modified polytetrafluoroethylene films in one coat which are substantially thicker than the thickest dry crack-free film which can be produced by an aqueous dispersion of polytetrafluoroethylene alone in one coat, which comprises blending an aqueous dispersion of polytetrafluoroethylene containing a wetting agent with a compatible aqueous dispersion of another resinous polymerized ethylenically unsaturated material, applying the resulting blend to a substrate in the form of a film, and drying, the second mentioned aqueous dispersion and said blend each having the property of drying at a temperature of at least 100° C. in one coat to a crack-free film having a thickness greater than the critical cracking thickness of said aqueous dispersion of polytetrafluoroethylene alone.

No references cited.