(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
26 October 2006 (26.10.2006)

PCT

(10) International Publication Number
WO 2006/113141 A2

(51) International Patent Classification:
C08K 3/30 (2006.01)

(21) International Application Number:
PCT/US2006/012810

(22) International Filing Date: 6 April 2006 (06.04.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/670,978	13 April 2005 (13.04.2005)	US
11/278,247	31 March 2006 (31.03.2006)	US

(71) Applicant *(for all designated States except US)*: **R.T. VANDERBILT COMPANY, INC.** [US/US]; 30 Winfield Street, P.O. Box 5150, Norwalk, Connecticut 06856-5150 (US).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **WEBSTER, Carrie, Ann** [US/US].

(74) Agent: **MONTANA, Mark, A.**; NORRIS, MCLAUGHLIN & MARCUS, P.A., 721 Route 202-206, 2nd Floor, Bridgewater, New Jersey 08807 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:
— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) **Title:** COMPOSITION AND METHOD FOR CURING LATEX COMPOUNDS

(57) **Abstract:** The invention pertains to a latex compound comprising a natural rubber or a synthetic rubber material and a curing system having organic peroxide. The invention also concerns a method of curing a latex film comprising the steps of forming a film from a latex compound comprising a natural rubber or synthetic rubber material and a curing system having organic peroxide and heating the film to obtain cured natural rubber or synthetic rubber materials.

WO 2006/113141 A2

COMPOSITION AND METHOD FOR CURING LATEX COMPOUNDS

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The invention pertains to compositions comprising organic peroxide which cross-link latex films. The invention further pertains to latex compounds comprising the compositions.

The Related Art

[0002] Latex compounds are conventionally cured by adding sulfur, a metal oxide activator, such as zinc oxide, and a combination of accelerators. The most common accelerators used in industry are thiurams, thiazoles and dithiocarbamates. An increased number of human beings have developed skin sensitivities to the accelerators commonly found in latex goods. Thus, use of latex products cured with conventional systems has led to an increase in delayed cutaneous hypersensitivity, also known as Type IV allergy. Type IV allergy occurs when the body perceives residual chemicals in the latex products as an antigen which interacts with specific T lymphocytes that release inflammatory and toxic substances leading to a skin reaction. Persons who experience Type IV allergy generally have an increased risk of developing Type I latex allergies.

[0003] Because of the increased risk of Type IV reactions, alternative means for curing latex articles are sought in the art. Latex compounds which can be cured without conventional accelerators, such as thiurams, thiazoles and dithiocarbamates, are particularly desired. Organic peroxide is discussed in the art as a curing agent in conjunction with metal oxides. Organic peroxide curing systems in the art, however, may require special processing conditions, such as use of molten salt bath, or other liquid bath or the use of high energy radiation. Conventional organic peroxide

systems do not function satisfactorily in open air systems, that is systems where the latex compounds are cured while being exposed to an external environment such as the inside of a heating chamber (oven) or ambient conditions.

[0004] Unless otherwise specified, all parts and percentages are on a weight by weight basis. Also, all parts and percentages set forth on a basis of parts per hundred rubber ("phr") are on a dry weight basis, unless otherwise specified.

SUMMARY OF THE INVENTION

[0005] The invention is a system for curing latex compounds that comprises organic peroxide, and, optionally, surfactant and/or antioxidant. The cure system can be combined with natural rubber and synthetic latex compositions, in other words a rubber material, to make latex compounds that can be cured (i.e. cross-linked) without the use of other accelerators, such as accelerators and activators used with conventional curing systems.

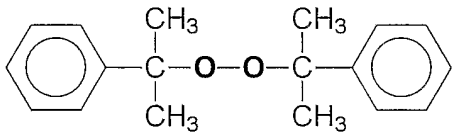
[0006] Latex compounds comprising the cure system can be cured in an open air environment or in closed systems. During the open air curing, the latex compounds will not become tacky, or will not obtain a level of tackiness that precludes effective open air curing. Thus, latex compounds comprising the cure system described herein require no special curing conditions, such as molten salt baths, or other liquid baths, or do not need to be cured by special curing systems like the application of radiation.

DETAILED DESCRIPTION OF THE INVENTION

[0007] The invention concerns a cure system for latex compounds. The cure system comprises organic peroxide, preferably an organic peroxide emulsion or dispersion, and, optionally, surfactant and antioxidant. In addition, the cure system may comprise coagents, and also processing aids, such as chemicals to control pH,

thickeners and other materials, such as materials to reduce tackiness. Curing systems comprising, consisting essentially of or consisting of one or more of organic peroxide, surfactant and antioxidant are within the scope of the invention.

[0008] Organic peroxide is a molecule containing at least two oxygen atoms connected by a single bond to organic chemical groups. An example of organic peroxide is depicted below:



Depending on the groups attached, the oxygen-oxygen bond is designed to break when heated, leaving one unpaired electron or free radical on each oxygen. These free radicals are able to promote certain chemical reactions, such as polymerization, the curing of thermosetting resins, and the crosslinking of elastomers. As organic peroxides decompose, they generate the free radicals that in turn create an active site on the polymer backbone. When organic peroxides are used for curing latex compounds, the reaction between the active sites produces a strong carbon-carbon bond between the polymer chains in the latex, which in turn leads to a polymer network with desirable mechanical properties, in particular excellent resistance to heat.

[0009] One or a combination of organic peroxides may be used in the invention Organic peroxides such as dialkyl peroxides and peroxyketals may be used. Examples of dialkyl peroxides include those selected from the group consisting of dicumyl peroxide (such as that available from Hercules Incorporated, Wilmington, Delaware, USA under the trade name DICUP R), 2,5-dimethyl-di-(t-butylperoxy)hexane, di-t-butylperoxide, t-butylcumyl-peroxide, bis(t-

butylperoxyisopropyl)benzene, butyl4,4-bis(t-butylperoxy)valerate, 2,5-bis(t-butylperoxy)-2,5-dimethylhexane, 2,5-bis(t-butylperoxy)-2,5-dimethyl-3-hexyne, t-butyl 3-isopropenylcumyl peroxide, bis(3-isopropenylcumyl) peroxide, 1,1-bis(t-butylperoxy)-3,3,5-trimethylcyclohexane, t-butylperoxybenzoate, and bis(2,4-dichlorobenzoyl) peroxide. Examples of organic peroxides that may be used in the invention include VAROX® 231, VAROX® DBPH, VAROX® 130 and VAROX® DCP, all available from R.T. Vanderbilt Co. Inc., Norwalk, Connecticut, USA ("Vanderbilt").

[0010] The organic peroxide may be in an emulsion (for liquid organic peroxides) or a dispersion (for solid organic peroxides) with water. The organic peroxide emulsion or dispersion comprises organic peroxide and water, and may consist essentially of or consist of organic peroxide and water. Generally, the emulsion or dispersion may comprise from about 10% to about 90% organic peroxide and about 10% to about 90% water, such as about 25% to about 75% organic peroxide and about 25% to about 75% water. The organic peroxide emulsion or dispersion may comprise, for example, from about 40% to about 60% organic peroxide and about 40% to about 60% water.

[0011] Surfactants useful in the invention include sodium lauryl sulfate (DARVAN® WAQ from Vanderbilt), t-Octylphenoxypolyethoxyethanol (TRITON® X-100 from the Union Carbide Corporation, Danbury, Connecticut, USA) and sulfated methyl oleate (DARVAN® SMO from Vanderbilt). Ammonium salts of alkyl phosphates, such as DARVAN® L from Vanderbilt, may also be used as a surfactant. Combinations of surfactants can be used. The surfactant also assists in decreasing the surface tack during open air curing of a latex compound comprising the curing system described herein.

[0012] The cure system optionally comprises antioxidants, such as amine, dithiocarbamate, hydroquinone, phenol, or toluimidazole antioxidant. Antioxidants useful in the invention include those available from Vanderbilt under the trade names AGERITE® STALITE®, AGERITE® STALITE® S, AGERITE® SUPERFLEX® Liquid, VANOX® AM Powder, VANOX® HT, VANOX® 12, VANOX® CDPA, VANOX® 1001, BUTYL ZIMATE® Powder, AGERITE® MA Pastilles, AGERITE® RESIN D® Pastilles, AGERITE SUPERLITE®, VANOX GT Powder, VANOX® L Powder, VANOX® MBPC, VANOX® 13, VANOX® 1290, VANOX® MTI, VANOX® ZMTI and VANOX® SPL slurry. Combinations of antioxidants can be used.

[0013] The cure system may comprise one or more coagents for cross-linking the latex compounds. For example, the cure system may further comprise triallylisocyanurate ("TAIC"), such as DIAK® 7 and/or m-phenylenedimaleimide, like VANAX® MBM (1H-Pyrrole-2-5-dione, 1, 1' (1, 3 phenylene) bis-), both available from Vanderbilt, or Triallyl Cyanurate (SR 507 (TAC) from Sartomer, Exton, Pennsylvania, USA). Other coagents useful in the invention include Difunctional Liquid Methacrylate (SR 297 (BGDMA)), Trifunctional Liquid Methacrylate (SR 350 (TMPTMA), Scorch-Retarded Liquid Dimethacrylate (SARET® SR 516), Scorch-Retarded Liquid Trimethacrylate (SARET® SR), Scorch-Retarded Liquid Triacrylate (SARET® SR 519), Scorch-Retarded Liquid Dimethacrylate (SARET® SR 521), Scorch-Retarded Solid Diacrylate (SARET® SR 522), Scorch-Retarded Metallic Diacrylate (SARET® 75 EPM 2A (75% active dispersion), SARET® SR 633) and Scorch-Retarded Metallic Dimethacrylate (SARET® SR 634 or SARET® 75 EPM 2M (75% active dispersion)) all available from Sartomer. Combinations of coagents may be used.

[0014] The cure system may further comprise other materials. Hydroxides, such as potassium hydroxide, can be included to control pH, such as the pH of a latex compound comprising the cure system. Thickeners, such as sodium polyacrylates like Paragum-231 from Para-Chem, Simpsonville, South Carolina, USA, may be used in the cure system. Also, zinc 2-mercaptotoluimidazole ("ZMTI"), for example VANOX® ZMTI from Vanderbilt, may be included in the composition for tack reduction, as well as additional antioxidant protection.

[0015] The invention encompasses latex compounds comprising the cure system. In this embodiment of the invention, the latex compounds comprise, at least, organic peroxide and heat curable natural or synthetic rubber type materials, in other words a rubber material, and optionally, surfactant and/or antioxidant. The latex compounds may comprise one or more of the materials (heat curable natural or synthetic rubber) selected from the group consisting of natural rubber, polyisoprene, polychloroprene, acrylonitrile, styrene-butadiene, sulfur cured butyl, and the like, and combinations thereof. In an aspect of the invention, the rubber material is a synthetic material such as those selected from the group consisting of polychloroprene, acrylonitrile, styrene butadiene and sulfur cured butyl, and particularly chosen from the group of polychloroprene and acrylonitrile. Useful polyisoprene materials include KRATON® polymers, such as KRATON® IR-401, from the KRATON® Polymers Group of Companies having offices in Houston, Texas, USA. Neoprene Liquid Dispersion, a polychloroprene from DuPont Performance Elastomers, Wilmington, Delaware, USA may be used. Useful acrylonitriles include carboxylated butadiene-acrylonitrile latexes such as TYLAC® 68073 from Dow-Reichhold Specialty Latex, LLC, Research Triangle Park, North Carolina, USA. HYCAR® acrylic emulsions available from NOVEON®, Inc.,

Cleveland, Ohio, USA may also be used in the latex compounds. Natural rubber latex is available from Getahindus (M) Sdn Bdh, Selangor Darul Ehsan, Malaysia, and also from Firestone Polymers, Akron, Ohio, USA.

[0016] In an embodiment of the invention, the latex compounds comprise from about 0.1 to about 5.0 phr organic peroxide, up to about 5.0 phr, such as about 0.1 phr to about 5 phr surfactant and up to about 5.0 phr, such as about 0.1 phr to about 5 phr antioxidant. Additionally, the latex compounds may comprise up to about 5.0 phr, such as about 0.1 phr to about 5 phr ZMTI. The latex compounds may comprise from about 0.1 to about 3 phr, preferably about 0.5 phr to 2 phr, organic peroxide. The organic peroxide may be added to the latex compound in an emulsion or dispersion with water. Coagents, such as TAIC and m-phenylenediamaleimide, may be used in amounts of up to about 5 phr, for example, from about 0.75 phr to about 3.75 phr. In an aspect of the invention, the latex compound is formulated and cured without the use of metal oxide, such as zinc oxide.

[0017] A small amount of sulfur in the latex compounds may be used in or with the cure system, such as from about 0.05 phr to about 1 phr, preferably about 0.1 phr to about 0.5 phr sulfur. The sulfur is found to provide further assistance with tack reduction.

[0018] The invention also concerns a method of curing a latex film from the latex compounds of the invention comprising the steps of forming a film from a latex compound comprising the cure system, i.e., at least the organic peroxide, and, optionally, surfactant and/or antioxidant, and heating the film for a period of time. The films should be cured according to the peroxide half-life time and temperature. The half-life time of the peroxide refers to the time or temperature at which 50% of the peroxide has decomposed. In the invention, the films of the latex compounds

may be cured for about 6 peroxide half-lifes to about 10 peroxide half-lifes to effectively cure or cross-link the latex compound, such that, in the curing cycle about 97% to about 100%, such as about 98.4% to about 99.9%, of the peroxide has decomposed. For example, the latex compound may be cured for about 5 minutes to about 50 minutes at about 90°C to about 180°C, such as about 10 minutes to about 40 minutes at about 100°C to about 175°C. In an embodiment of the invention, the film is cured for about 10 minutes to about 30 minutes at about 130° C to about 160° C, preferably at about 140° to about 150°C.

[0019] The latex is preferably cured in an open air system, that is the curing may occur such that the latex is exposed to air when it is cured. The organic peroxide, with the surfactant, particularly the sodium lauryl sulfate and sulfated methyl oleate, combined with the ZMTI, were found as beneficial to minimize tackiness during the open air curing cycle, although other combinations of compounds within the scope of the invention also minimize tackiness in the open air cycle.

[0020] In the curing process, the organic peroxides form carbon to carbon bonds between individual polymer chains in the latex compound. The carbon to carbon bond is stronger and more thermally stable than the sulfur to sulfur bonds formed by elemental sulfur vulcanization. The use of a sulfur donor system to cure latex compounds will primarily form carbon to sulfur type bonds, the thermal stability of which falls between that of sulfur to sulfur and carbon to carbon bonds. The higher strength of the covalent carbon to carbon bond network obtained through curing with the organic peroxide results in optimum thermal stability in the cured latex compound which is beneficial to cured latex products made from latex compounds cured with organic peroxides in accordance with the invention. One aspect of the invention is a

curing system which creates carbon-carbon cross link bonds without establishing any carbon-sulfur or sulfur-sulfur cross links in the cured latex compound.

[0021] The latex compounds can be used to make a wide variety of cured latex products. Examples of products that may be made with the latex compounds of the invention are gloves, condoms, carpet backing, threads and adhesives.

EXAMPLES

In the examples the degree of surface tack *(i.e.* tackiness) of films made from the various latex compounds was determined. The test involved a person touching the cured films and then evaluating the degree of surface tack based on a sliding scale of 1 to 5. The criteria for the sliding scale was as follows: 1 indicating no tack or a degree of surface tack generally found with articles subjected to conventional sulfur cure, 3 indicating a degree of surface tack that was sticky but did not render the file unusable, and 5 indicating a degree of surface tack rendering the films unusable. The degree of surface tack is set forth below in each example.

EXAMPLES 1A, 1B, 1C

[0022] Synthetic carboxylated butadiene-acrylonitrile latex compounds having the compositions set forth in Table 1 were formulated by methods known in the art. All components set forth in Table 1 are reported as phr. The wet formulation of these examples (i.e. after water is added) include the thickener (Paragum-231 from Para-Chem) in an amount of 2.84 phr(wet). The potassium hydroxide was from Mallinckrodt Chemicals of Mallinckrodt Baker, Inc. ("Mallinckrodt"), Phillipsburg, New Jersey, USA.

[0023] Films made from the latex compound of Examples 1A and 1B were cured for 30 minutes at 120°C after drying at room temperature, and the film made from the latex compound of 1C was cured for 40 minutes at 120°C. The tensile at maximum

load, strain at maximum load, 300% modulus and 500% modulus of one or more samples of the cured films were tested in accordance with ASTM Test Method D412-98a (2002) e1 "Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomer – Tension" which is incorporated herein by reference in its entirety. The average test results are set forth in Table 2. Also, the degree of surface tack was determined in accordance with the procedure discussed above and those results are set forth in Table 2.

Table 1

Components	Example 1A	Example 1B	Example 1C	Ingredient Supplier or Tradename
Carboxylated Butadiene Acrylonitrile	100	100	100	HYCAR® 1570 x 79
Sodium lauryl sulfate	1	1	1	DARVAN® WAQ
Blend of phenolic AO and ZMTI	2	2	2	VANOX® SPL Slurry
Methyl Oleate Salt	0.5	.05	0.5	DARVAN® SMO
Potassium Hydroxide	1	1	1	Mallinckrodt
Organic Peroxide	1	2	2	VAROX® 231

Table 2

Test Applied	Results		
	Example 1A	Example 1B	Example 1C
Tensile at Max Load, MPa	8.52	10.08	13.22
Strain at Max Load, %	880.52	868.82	863.79
300 % Modulus, MPa	1.55	1.65	1.84
500% Modulus, MPa	1.99	2.22	2.57
Degree of Surface Tack	1	1	1

EXAMPLE 1D

[0024] A synthetic carboxylated butadiene-acrylonitrile latex compound having the composition set forth in Table 1A was formulated by methods known in the art. All components set forth in Table 1A are reported as phr. The wet formulation of this example (i.e. after water is added) includes the Paragum-231 thickener in an amount of 2.84 phr(wet).

[0025] A film made from the latex compound of Example 1D was cured for 30 minutes at 120°C after drying at room temperature. The tensile at maximum load, strain at maximum load, 300% modulus and 500% modulus of one or more samples of the cured film were tested in accordance with ASTM Test Method D412-98a (2002) e1. The average test results are set forth in Table 2A. Also, the degree of surface tack was determined in accordance with the procedure set forth above and the result is presented in Table 2A.

Table 1A

Components	Example 1D	Ingredient Supplier or Tradename
Carboxylated Butadiene Acrylonitrile	100	HYCAR® 1570 x 79
Sodium lauryl sulfate	1	DARVAN® WAQ
Blend of phenolic AO and ZMTI	2	VANOX® SPL Slurry
Methyl Oleate Salt	0.5	DARVAN® SMO
Potassium Hydroxide	1	Mallinckrodt
Organic Peroxide	1	VAROX® DBPH

Table 2A

Test Applied	Results Example 1D
Tensile at Max Load, MPa	9.18
Strain at Max Load, %	873.57
300 % Modulus, MPa	1.65
500% Modulus, MPa	2.15
Degree of SurfaceTack	1

EXAMPLE 1E

[0026] A synthetic carboxylated butadiene-acrylonitrile latex compound having the composition set forth in Table 1B was formulated by methods known in the art. All components set forth in Table 1B are reported as phr. The wet formulation of this example (i.e. after water is added) includes the Paragum-231 thickener in an amount of 2.84 phr(wet).

[0027] A film made from the latex compound of Example 1E was cured for 30 minutes at 140°C after drying at room temperature. The tensile at maximum load, strain at maximum load, 300% modulus and 500% modulus of one or more samples of the cured film were tested in accordance with ASTM Test Method D412-98a (2002) e1. The average test results are set forth in Table 2B. Also, the degree of surface tack was determined in accordance with the procedure set forth above and the result is presented in Table 2B.

Table 1B

Components	Example 1E	Ingredient Supplier or Tradename
Carboxylated Butadiene Acrylonitrile	100	HYCAR® 1570 x 79
Sodium lauryl sulfate	1	DARVAN® WAQ
Blend of phenolic AO and ZMTI	2	VANOX® SPL Slurry
Potassium Hydroxide	0.5	Mallinckrodt
Methyl Oleate Salt	1	DARVAN® SMO
Alkyl Phosphate Salt	0.5	DARVAN® L
Zinc 2-mercaptotoluimidazole	1	VANOX® ZMTI
Organic Peroxide	1	VAROX® 231 (50% emulsion)

Table 2B	
Test Applied	Results Example 1E
Tensile at Max Load, MPa	7.43
Strain at Max Load, %	753
300 % Modulus, MPa	2.27
500% Modulus, MPa	2.98
Degree of Surface Tack	1

EXAMPLE 1F

[0028] A synthetic carboxylated butadiene-acrylonitrile latex compound having the composition set forth in Table 1C was formulated by methods known in the art. All components set forth in Table 1C are reported as phr. The wet formulation of this example (i.e. after water is added) includes the Paragum-231 thickener in an amount of 2.84 phr(wet).

[0029] A film made from the latex compound of Example 1F was cured for 15 minutes at 150°C after drying at room temperature. The tensile at maximum load, strain at maximum load, 300% modulus and 500% modulus of one or more samples of the cured film were tested in accordance with ASTM Test Method D412-98a (2002) e1. The average test results are set forth in Table 2C. Also, the degree of surface tack was determined in accordance with the procedure set forth above and the result is presented in Table 2C.

Table 1C		
Components	**Example 1F**	**Ingredient Supplier or Tradename**
Carboxylated Butadiene Acrylonitrile	100	HYCAR® 1570 x 79
Sodium lauryl sulfate	1	DARVAN® WAQ
Zinc 2-mercaptotoluimidazole	2	VANOX® SPL Slurry
m-phenylenedimaleimide	1	VANAX® MBM
Potassium Hydroxide	1	Mallinckrodt
Organic Peroxide	1	VAROX® 231 (50% emulsion)

Table 2C	
	Results
Test Applied	**Example 1F**
Tensile at Max Load, MPa	12.83
Strain at Max Load, %	771.19
300 % Modulus, MPa	1.74
500% Modulus, MPa	2.88
Degree of Surface Tack	1

EXAMPLES 2 and 3

[0030] Natural latex rubber compounds having the compositions set forth in Table 3 were formulated by methods known in the art. All components set forth in Table 3 are reported as phr. Example 3 is a comparative example which includes sulfur, zinc oxide and zinc dibutyldithiocarbamate as a curing system. Zinc oxide is generally available from Zinc Corporation of America, Monaca, Pennsylvania, USA, and sulfur is generally available from R.E. Carroll Inc., Trenton, New Jersey, USA.

[0031] Films having thicknesses of about 10 mils to about 40 mils were made from compounds of Examples 2 and 3. Films made from these latex compounds were cured for 10 minutes at 150°C, and a film made from Example 2 was cured for

20 minutes at 100°C. Some or all of the tensile strength, tensile at maximum load, elongation, strain at maximum load, 300% modulus and 500% modulus of one or more samples of each cured film were tested applying ASTM Test Method D412-98a (2002) e1. The average test results are set forth in Table 4. Also, the degree of surface tack was determined in accordance with the procedures set forth above and the results are presented in Table 4.

Table 3

Components	Example 2	Example 3	Ingredient Supplier or Tradename
Natural Rubber Latex	100	100	Getahindus (M) Sdn Bhd
Sodium lauryl sulfate	1	1	DARVAN® WAQ
Methyl Oleate Salt	0.5	0.5	DARVAN® SMO
Potassium Hydroxide	0.5	0.5	Mallinckrodt
Organic Peroxide	1	---	VAROX® 231 (50% emulsion)
Blend of phenolic AO and ZMTI	2	2	VANOX® SPL Slurry
Sulfur	---	2	Various
Zinc Oxide	---	0.5	Various
Zinc dibutyldithiocarbamate	---	1	BUTYL ZIMATE®

Table 4

Test Applied	Results Example 2 (Cured at 150°C)	Example 2 (Cured at 100°C)	Example 3
Tensile Strength, MPa	19.22	---	30.13
Tensile at Max Load, MPa	19.22	5.37	31.50
Elong.,%	896.95	---	886.83
Strain at Max Load, %	896.95	847.47	886.54
300 % Modulus, MPa	1.07	0.75	1.56
500% Modulus, MPa	1.70	1.06	2.40
Degree of Surface Tack	3	3	1

EXAMPLES 4-6

[0032] Natural latex rubber compounds having the compositions set forth in Table 5 were formulated by methods known in the art. All components set forth in Table 5 are reported as phr.

[0033] Films having thicknesses of about 10 mils to about 40 mils made from compounds of Examples 4-6 were cured for 10 minutes at 150 °C. Some or all of the tensile strength, tensile at maximum load, elongation, strain at maximum load, 300% modulus and 500% modulus of one or more samples of each cured film were tested applying ASTM Test Method D412-98a (2002) e1. The average test results are set forth in Table 6. Also, the degree of surface tack was determined in accordance with the procedure set forth above and the results are presented in Table 6.

Table 5

Components	Example 4	5	5A	6	Ingredient Supplier or Tradename
Natural Rubber Latex	100	100	100	100	Getahindus (M) Sdn Bhd
Sodium lauryl sulfate	1	1	1	1	DARVAN® WAQ
Methyl Oleate Salt	1	1	0.5	1	DARVAN® SMO
Potassium Hydroxide	0.5	0.5	0.5	0.5	Mallinckrodt
Organic Peroxide	1	1	1	1	VAROX® 231 (50% emulsion)
Blend of phenolic AO and ZMTI	2	2	2	2	VANOX® SPL Slurry
Sulfur	---	---	---	0.1	Various
Alkyl Phosphate salt	0.5	0.5	0.5	---	DARVAN® L
Zinc 2-mercaptotoluimidazole	---	1	1	1	VANOX® ZMTI

Table 6				
	Results			
	Example			
Test Applied	4	5	5A	6
Tensile Strength, MPa	13.11	10.79	---	14.32
Tensile at Max Load, MPa	13.11	13.92	10.21	14.32
Elong.,%	861.46	862.40	---	880.69
Strain at Max Load, %	861.46	861.68	833.57	880.69
300 % Modulus, MPa	0.88	0.81	0.88	0.88
500% Modulus, MPa	1.34	1.26	1.31	1.36
Degree of Tackiness	3	3	3	3

EXAMPLES 7-11

[0034] Neoprene 750 Liquid Dispersion compounds having the compositions set forth in Table 7 were formulated by methods known in the art. All components set forth in Table 7 are reported as phr. The wet formulation of these examples (i.e. after water is added) includes the Paragum-231 thickener in an amount of 2.3 phr(wet).

[0035] Films having thicknesses of about 10 mils to about 40 mils made from compounds of Examples 7-11 were cured for 10 minutes at 150 °C. The tensile strength, tensile at maximum load, elongation, strain at maximum load, 300% modulus and 500% modulus of one or more samples of each cured film were tested applying ASTM Test Method D412-98a (2002) e1. The average test results are set forth in Table 8. Also, the degree of surface tack was determined in accordance with the procedure set forth above and the results are presented in Table 8.

Table 7						
Components	Example 7	8	9	10	11	Ingredient Supplier or Tradename
Neoprene	100	100	100	100	100	Dupont-Dow Elastomers
Sodium lauryl sulfate	1	1	1	1	1	DARVAN® WAQ
Methyl Oleate Salt	1	0.5	1	0.5	1	DARVAN® SMO
Potassium Hydroxide	1	1	1	1	1	Mallinckrodt
Organic Peroxide	1	1	1	1	1	VAROX® 231 (50% emul-sion)
Blend of phenolic AO and ZMTI	2	2	2	2	2	VANOX ® SPL Slurry
Sulfur	0.1	---	---	0.1	0.1	Various
Alkyl Phosphate salt	---	0.5	0.5	0.5	0.5	DARVAN® L
Zinc 2-mercaptotoluimidazole	1	1	---	1	1	VANOX® ZMTI

Table 8					
	Results				
	Example				
Test Applied	7	8	9	10	11
Tensile Strength, MPa	18.98	16.33	13.00	18.24	15.57
Tensile at Max Load, MPa	22.21	16.33	13.01	18.24	15.57
Elong.,%	927.05	990.15	1000.66	973.46	971.47
Strain at Max Load, %	926.71	990.15	1000.66	973.46	971.47
300 % Modulus, MPa	1.63	1.46	1.30	1.52	1.57
500% Modulus, MPa	2.39	1.95	1.71	1.99	2.16
Degree of Surface Tack	1	1	1	1	1

EXAMPLES 12-16

[0036] Latex compounds of Neoprene 750 Liquid Dispersion having the compositions set forth in Table 9 were formulated by methods known in the art. All components set forth in Table 9 are reported as phr. The wet formulation of these

examples (i.e. after water is added) includes the Paragum-231 thickener in an amount of 2.3 phr(wet).

[0037] Films having thicknesses of about 10 mils to about 40 mils made from compounds of Examples 12-16 were subjected to two separate curing conditions. Samples of the films were cured for 10 minutes at 150 °C, and other samples of the films were cured for 30 minutes at 140 °C. The tensile strength, tensile at maximum load, elongation, strain at maximum load, 300% modulus and 500% modulus of one or more samples of each film cured under the two conditions were tested applying ASTM Test Method D412-98a (2002) e1. The average test results for the samples cured for 10 minutes at 150 °C are set forth in Table 10, and the average test results for the samples cured for 30 minutes at 140 °C are set forth in Table 11. Also, the degree of surface tack was determined in accordance with the procedure set forth above and the results are presented in Tables 10 and 11.

Table 9

Components	Example 12	13	14	15	16	Ingredient Supplier or Tradename
Neoprene	100	100	100	100	100	DuPont Performance Elastomers
Sodium lauryl sulfate	1	1	1	1	1	DARVAN® WAQ
Methyl Oleate Salt	1	1	1	1	1	DARVAN® SMO
Potassium Hydroxide	1	1	1	1	1	Mallinckrodt
Organic Peroxide	1	2	3	4	5	VAROX® 231 (50% emul-sion)
Blend of phenolic AO and ZMTI	2	2	2	2	2	VANOX ® SPL Slurry
Sulfur	0.1	0.1	0.1	0.1	0.1	Various
TAIC (Coagent)	0.75	1.50	2.25	3.00	3.75	DIAK® 7
Zinc 2-mercaptotoluimidazole	1	1	1	1	1	VANOX® ZMTI

Table 10					
	Results				
	Example				
Test Applied	12	13	14	15	16
Tensile Strength, MPa	15.42	20.01	22.75	18.48	16.15
Tensile at Max Load, MPa	15.42	21.14	22.75	18.48	18.44
Elong.,%	909.06	901.52	883.07	769.00	729.16
Strain at Max Load, %	909.06	901.18	882.82	769.00	728.91
300 % Modulus, MPa	1.45	1.55	1.60	1.81	1.84
500% Modulus, MPa	2.88	2.18	2.41	3.08	3.48
Degree of Surface Tack	1	1	1	1	1

Table 11					
	Results				
	Example				
Test Applied	12	13	14	15	16
Tensile Strength, MPa	23.88	28.72	19.93	17.21	23.14
Tensile at Max Load, MPa	23.88	28.72	19.93	18.75	23.14
Elong.,%	917.97	908.35	798.21	705.45	825.77
Strain at Max Load, %	917.97	908.35	798.21	705.02	825.77
300 % Modulus, MPa	1.46	1.69	1.71	2.06	1.67
500% Modulus, MPa	2.06	2.48	2.80	4.01	2.87
Degree of Surface Tack	1	1	1	1	1

EXAMPLES 17-21

[0038] Latex compounds of Neoprene 750 Liquid Dispersion having the compositions set forth in Table 12 were formulated by methods known in the art. All components set forth in Table 12 are reported as phr. The wet formulation of these examples (i.e. after water is added) includes the Paragum-231 thickener in an amount of 2.3 phr(wet).

[0039] Films having thicknesses of about 10 mils to about 40 mils made from compounds of Examples 17-21 were subjected to two separate curing conditions. Samples of the films were cured for 10 minutes at 150 °C, and other samples of the films were cured for 30 minutes at 140 °C. The tensile at maximum load, strain at

maximum load, 300% modulus and 500% modulus of one or more samples of each film cured under the two conditions were tested applying ASTM Test Method D412-98a (2002) e1. The average test results for the samples cured for 10 minutes at 150 °C are set forth in Table 13, and the average test results for the samples cured for 30 minutes at 140 °C are set forth in Table 14. Also, the degree of surface tack was determined in accordance with the procedure set forth above and the results are presented in Tables 13 and 14.

Table 12

Components	Example 17	18	19	20	21	Ingredient Supplier or Tradename
Neoprene	100	100	100	100	100	DuPont Performance Elastomers
Sodium lauryl sulfate	1	1	1	1	1	DARVAN® WAQ
Methyl Oleate Salt	1	1	1	1	1	DARVAN® SMO
Potassium Hydroxide	1	1	1	1	1	Mallinckrodt
Organic Peroxide	1	1	1	1	1	VAROX® 231 (50% emul-sion)
Blend of phenolic AO and ZMTI	2	2	2	2	2	VANOX ® SPL Slurry
Sulfur	0.1	0.1	0.1	0.1	0.1	Various
TAIC (Coagent)	0.25	0.5	0.75	1.00	1.50	DIAK® 7
Zinc 2-mercaptotoluimidazole	1	1	1	1	1	VANOX® ZMTI

Table 13

Test Applied	Results Example 17	18	19	20	21
Tensile at Max Load, MPa	24.55	18.23	23.47	18.80	20.82
Strain at Max Load, %	841.31	755.55	851.22	825.26	827.76
300 % Modulus, MPa	1.79	2.14	1.72	1.71	1.71
500% Modulus, MPa	3.04	3.69	2.73	2.71	2.76
Degree of Surface Tack	1	1	1	1	1

Table 14					
	Results				
	Example				
Test Applied	17	18	19	20	21
Tensile at Max Load, MPa	19.85	24.38	20.01	20.12	22.58
Strain at Max Load, %	774.00	815.44	764.37	786.19	799.87
300 % Modulus, MPa	2.16	2.11	2.03	1.96	1.97
500% Modulus, MPa	3.84	3.76	3.67	3.31	3.40
Degree of Surface Tack	1	1	1	1	1

EXAMPLES 22-26

[0040] Neoprene 750 Liquid Dispersion compounds having the compositions set forth in Table 15 were formulated by methods known in the art. All components set forth in Table 15 are reported as phr. The wet formulation of these examples (i.e. after water is added) includes the Paragum-231 thickener in an amount of 2.3 phr(wet).

[0041] Films having thicknesses of about 10 mils to about 40 mils made from compounds of Examples 22-26 were cured for 15 minutes at 175 °C. The tensile at maximum load, strain at maximum load, 300% modulus and 500% modulus of one or more samples of each cured film were tested applying ASTM Test Method D412-98a (2002) e1. The average test results are set forth in Table 16. Also, the degree of surface tack was determined in accordance with the procedure set forth above and the results are presented in Table 16.

Table 15						
Components	Example 22	23	24	25	26	Ingredient Supplier or Tradename
Neoprene	100	100	100	100	100	DuPont Performance Elastomers
Sodium lauryl sulfate	1	1	1	1	1	DARVAN® WAQ
Methyl Oleate Salt	1	1	1	1	1	DARVAN® SMO
Potassium Hydroxide	1	1	1	1	1	Mallinckrodt
Organic Peroxide	1	3	4	5	1	VAROX® DBPH (50% emulsion)
Blend of phenolic AO and ZMTI	2	2	2	2	2	VANOX ® SPL Slurry
Sulfur	0.1	0.1	0.1	0.1	0.1	Various
TAIC (Coagent)	0.75	2.25	3.00	3.75	---	DIAK® 7
Zinc 2-mercaptotoluimidazole	1	1	1	1	1	VANOX® ZMTI

Table 16					
	Results				
	Example				
Test Applied	22	23	24	25	26
Tensile at Max Load, MPa	36.94	31.84	26.22	26.46	28.42
Strain at Max Load, %	796.42	739.17	698.89	712.62	712.67
300 % Modulus, MPa	2.22	2.14	2.23	2.24	2.28
500% Modulus, MPa	4.91	5.74	6.20	5.80	5.94
Degree of Surface Tack	1	1	1	1	1

EXAMPLES 27-28

[0042] Natural latex rubber compounds having the compositions set forth in Table 17 were formulated by methods known in the art. All components set forth in Table 17 are reported as phr.

[0043] Films having thicknesses of about 10 mils to about 40 mils made from compounds of Examples 27-28 were cured for 12 minutes at 150 °C. The tensile at

maximum load, strain at maximum load, 300% modulus and 500% modulus of one or more samples of each cured film were tested applying ASTM Test Method D412-98a (2002) e1. The average test results are set forth in Table 18. Also, the degree of surface tack was determined in accordance with the procedure set forth above and the results are presented in Table 18.

Table 17

Components	Example 27	Example 28	Ingredient Supplier or Tradename
Natural Rubber Latex	100	100	Sdn Bhd Firestone Polymers
Sodium lauryl sulfate	1	1	DARVAN® WAQ
Methyl Oleate Salt	1	1	DARVAN® SMO
Potassium Hydroxide	1	1	Mallinckrodt
Organic Peroxide	3	5	VAROX® 231 (50% Emulsion)
Blend of phenolic AO and ZMTI	2	2	VANOX® SPL Slurry
Sulfur	0.1	0.1	Various
Phenol AO	1	1	VANOX® L
TAIC (Coagent)	2.25	3.75	DIAK® 7

Table 18

Test Applied	Results Example 27	Example 28
Tensile at Max Load, MPa	10.17	18.05
Strain at Max Load, %	751.82	713.24
300 % Modulus, MPa	1.01	1.59
500% Modulus, MPa	1.64	2.95
Degree of Surface Tack	3	3

CLAIMS

I claim:

1. A latex compound comprising a rubber material and a curing system having an emulsion or dispersion comprising about 10% to about 90% organic peroxide and about 10% to about 90% water.

2. The latex compound of Claim 1 wherein the organic peroxide is selected from the group consisting of dicumyl peroxide, 2,5-dimethyl-di-(t-butylperoxy)hexane, di-t-butylperoxide, t-butylcumyl-peroxide, bis(t-butylperoxyisopropyl)benzene, butyl4,4-bis(t-butylperoxy)valerate, 2,5-bis(t-butylperoxy)-2,5-dimethylhexane, 2,5-bis(t-butylperoxy)-2,5-dimethyl-3-hexyne, t-butyl 3-isopropenylcumyl peroxide, bis(3-isopropenylcumyl) peroxide, 1,1-bis(t-butylperoxy)-3,3,5-trimethylcyclohexane, t-butylperoxybenzoate, and bis(2,4-dichlorobenzoyl) peroxide.

3. The latex compound of Claim 1 wherein the rubber material is selected from the group consisting of natural rubber, polyisoprene, polychloroprene, acrylonitrile, styrene-butadiene, sulfur cured butyl, and combinations thereof.

4. The latex compound of Claim 1 wherein the rubber material is selected from the group consisting of polychloroprene, acrylonitrile, styrene-butadiene and sulfur cured butyl.

5. The latex compound of Claim 1 further comprising a surfactant.

6. The latex compound of Claim 5 wherein the surfactant is selected from the group consisting of sodium lauryl sulfate, sulfated methyl oleate, t-Octylphenoxypolyethoxyethanol, ammonia salts of alkyl phosphates and combinations thereof.

7. The latex compound of claim 6 further comprising zinc 2-mercaptotoluimidazole.

8. The latex compound of Claim 1 wherein the latex compound further comprises an antioxidant.

9. The latex compound of Claim 1 further comprising sulfur.

10. A cured rubber material obtained by curing the latex compound of claim 1.

11. A latex compound comprising a rubber material and a curing system having an organic peroxide and a surfactant.

12. The latex compound of Claim 11 further comprising an antioxidant.

13. The latex compound of Claim 11 wherein the surfactant is selected from the group consisting of sodium lauryl sulfate, sulfated methyl oleate, t-Octylphenoxypolyethoxyethanol, ammonia salts of alkyl phosphates and combinations thereof.

14. The latex compound of Claim 13 further comprising zinc 2-mercaptotoluimidazole.

15. The latex compound of Claim 11 wherein the rubber material is selected from the group consisting of natural rubber, polyisoprene, polychloroprene, acrylonitrile, styrene-butadiene, sulfur cured butyl, and combinations thereof.

16. The latex compound of Claim 11 wherein the rubber material is selected from the group consisting of polychloroprene, acrylonitrile, styrene-butadiene and sulfur cured butyl.

17. The latex compound of Claim 11 further comprising sulfur.

18. A cured rubber material obtained by curing the latex compound of claim 11.

19. A method of curing a latex film comprising the steps of forming a film from a latex compound having a rubber material and a curing system comprising organic peroxide and heating the film for about 6 peroxide half-lives to about 10 peroxide half-lives.

20. The method of Claim 19 wherein the curing system is an emulsion or dispersion of organic peroxide in water comprising from about 10% to about 90% organic peroxide and about 10% to about 90% water.

21. The method of Claim 19 wherein the latex compound further comprises a surfactant.

22. The method of Claim 19 wherein the rubber material is selected from the group consisting of polychloroprene, acrylonitrile, styrene-butadiene and sulfur cured butyl.

23. The method of Claim 19 wherein the film is heated in an open air system.