



(86) Date de dépôt PCT/PCT Filing Date: 2012/11/29
(87) Date publication PCT/PCT Publication Date: 2013/06/06
(45) Date de délivrance/Issue Date: 2021/06/01
(85) Entrée phase nationale/National Entry: 2014/05/29
(86) N° demande PCT/PCT Application No.: US 2012/067007
(87) N° publication PCT/PCT Publication No.: 2013/082255
(30) Priorité/Priority: 2011/11/30 (US61/565,215)

(51) Cl.Int./Int.Cl. *C09D 195/00* (2006.01),
C04B 41/48 (2006.01), *C09D 201/00* (2006.01),
C09D 7/63 (2018.01), *E01C 19/48* (2006.01),
E01C 21/00 (2006.01), *E01C 7/35* (2006.01)
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(54) Titre : COMPOSITIONS D'ASPHALTE AYANT DES PROPRIETES AMELIOREES ET REVETEMENTS ET
PROCEDES ASSOCIES
(54) Title: ASPHALT COMPOSITIONS HAVING IMPROVED PROPERTIES AND RELATED COATINGS AND METHODS

(57) **Abrégé/Abstract:**

A composition to coat a substrate comprising: an asphalt material; a polymer that is not a polyol; and a polyol. The polyol has a molecular weight of about 1000 to about 5000 and/or the polyol is present in an amount no greater than about 30% by weight of the total composition. Coated articles comprise a substrate coated with a coating layer, wherein the coating layer is formed from a composition that comprises: an asphalt material, a polymer that is not a polyol; and a polyol. Methods of improving the processability of an asphalt material comprise combining together an asphalt material, a polymer that is not a polyol, and a polyol, wherein the resultant composition exhibits improved process ability as compared to an asphalt composition that does not contain a polyol.

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

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
6 June 2013 (06.06.2013)

(10) International Publication Number
WO 2013/082255 A1

(51) International Patent Classification:

C08K 5/00 (2006.01) *E01C 21/00* (2006.01)
C08L 95/00 (2006.01)

(21) International Application Number:

PCT/US2012/067007

(22) International Filing Date:

29 November 2012 (29.11.2012)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

61/565,215 30 November 2011 (30.11.2011) US

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(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,

BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, 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:

- with international search report (Art. 21(3))

(54) Title: ASPHALT COMPOSITIONS HAVING IMPROVED PROPERTIES AND RELATED COATINGS AND METHODS

(57) Abstract: A composition to coat a substrate comprising: an asphalt material; a polymer that is not a polyol; and a polyol. The polyol has a molecular weight of about 1000 to about 5000 and/or the polyol is present in an amount no greater than about 30% by weight of the total composition. Coated articles comprise a substrate coated with a coating layer, wherein the coating layer is formed from a composition that comprises: an asphalt material, a polymer that is not a polyol; and a polyol. Methods of improving the processability of an asphalt material comprise combining together an asphalt material, a polymer that is not a polyol, and a polyol, wherein the resultant composition exhibits improved process ability as compared to an asphalt composition that does not contain a polyol.



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TITLE OF THE INVENTION

[0001] Asphalt Compositions Having Improved Properties And Related Coatings and Methods

CROSS-REFERENCE TO RELATED APPLICATION

- 5 [0002] This application claims the benefit under 35 U.S.C. §119(e) to U.S. Provisional Patent Application No. 61/565,215, filed November 30, 2011, entitled "Asphalt Compositions Having Improved Properties and Related Coatings and Methods."

BACKGROUND OF THE INVENTION

- 10 [0003] Asphalt or bitumen is a mixture of various hydrocarbons and contains varying amounts of paraffinic, naphthenic, and aromatic hydrocarbons. It has properties which make it useful in a number of applications including as a surface application to a road bed or road surface, a sealing compound, a coating material, a waterproofing material. It may also be used to protect building structures or components of building structures, and as a
15 caulking or waterproofing material.

- [0004] Neat bitumen generally has little or no elasticity. Thus, asphalt processing is difficult and resultant coatings or pavement layers comprised of bitumen are brittle at low temperatures and soft at higher temperatures. Numerous products have been developed in an attempt to modify the bitumen and provide it with elasticity, reduced brittleness and
20 increased processability. Such attempts include blending the bitumen with amounts of various polymers, most commonly SBS. The objective of using polymers as bitumen additives is to alter the viscoelastic properties of bitumen, in particular to extend the plasticity range and to improve the elastic restoration. These materials are commonly referred to as "polymer modified bitumens" (PMBs).

- 25 [0005] The process of preparing PMBs requires heating and shear mixing of the polymer and the bitumen which give the high viscosity of the bitumen, requires application of significant shear rates, relatively high temperatures in the reactors, and longer processing times.

- [0006] While PMBs have been considered an improvement over neat bitumens, the end
30 products still lack sufficient flexibility, particularly at lower temperatures (such as those present during most road maintenance operations). Moreover, the difficulties associated with the processing of PMB remain a challenge.

[0007] United States Patent No. 4,902,349 to Wakizaka describes the difficulties associated with the mixing of asphalt and a polyol, reporting that asphalt separates from the polyol because of poor compatibility. To overcome this difficulty, Wakizaka uses high levels of polyol (40% by weight or greater) and requires use of a surface active agent and a plasticizer. Wakizaka teaches that its composition is prepared by “utilizing the behavior of a plasticizer according to the polymer solution theory and the surface-modifying effect of the plasticizer according to surface chemistry.” The Wakizaka method and composition are flawed and commercial infeasible because of the costs added by use of the large amount of polyol and the additional required ingredients. There remains a need in the art for a lower cost flexible asphalt that can be used commercially in large quantities without being cost prohibitive.

BRIEF SUMMARY OF THE INVENTION

[0008] The invention includes a composition to coat a substrate comprising: an asphalt material; a polymer that is not a polyol; and a polyol. The polyol has a molecular weight of about 1000 to about 5000 and/or the polyol is present in an amount no greater than about 30% by weight of the total composition. Also included are coated articles that comprise a substrate coated with a coating layer, wherein the coating layer is formed from an composition that comprises: an asphalt material, a polymer that is not a polyol; and a polyol. In some embodiments, the polyol of the composition of the coated article has a molecular weight of about 1000 to about 5000 or it may be present in an amount no greater than 30% by weight of the total composition (before the composition is cured).

[0009] Also included are methods of improving the processability of a asphalt material comprising combining together an asphalt material, a polymer that is not a polyol, and a polyol, wherein the resultant composition exhibits improved processability as compared to an asphalt composition that does not contain a polyol. In the method in some embodiments, the polyol may be present in the resultant composition in an amount of no greater than 30% by weight and/or the polyol may have a molecular weight of about 1000 to about 5000. In some embodiments, the composition of the method does not contain at least one of a plasticizer and a surface active agent.

[0010] Methods of improving flexibility of a cured asphalt coating comprising incorporating together an asphalt material, a polymer that is not a polyol, and a polyol to form an composition, applying the composition to a substrate and curing, to form a coating layer, wherein the coating layer exhibits improved flexibility at temperatures below 0°C as compared to an asphalt composition that does not contain a polyol are also disclosed.

DETAILED DESCRIPTION OF THE INVENTION

[0011] The above-described drawbacks are addressed by the invention, which encompasses compositions, coating layers and products formed from the compositions, and substrates or surfaces, particularly roadbeds and building materials, that are coated with the coating layer. Also included within the scope of the invention are methods of increasing the flexibility, for example, at temperatures below about 0°C, of an asphalt coating and methods of increasing the processability of asphalt-containing compositions. Once formed and cured, the coating layer provides to the substrate or surface waterproofing properties and protection from physical damage.

10 [0012] It has been found that a composition containing an asphalt material, a polymer and a polyol exhibits improved processability and improved flexibility when cured, which in turn results in increased durability and reduced delamination of the asphalt composition coating, properties that may be particularly desirable when the material is used in road beds or to coat other building and infrastructure materials and components. Advantageously, it has been discovered that these properties are achieved through relatively minimal loading of polymer and polyol as compared to the amount of asphalt and other materials in the composition, reducing the costs of the overall material and of processing.

[0013] The composition of the invention includes an asphalt or bituminous material that may form a flexible barrier or coating when cured. The asphalt material may include any known or to be developed in the art. It may be added to the composition in the form of a pre-mixed asphalt composition or as neat asphalt. Any asphalt may be selected; it may be preferred that the asphalt has a low oil content. For example, the composition of the invention may include a de-asphaltized "DA" grade asphalt. As is understood in the art, DA grade asphalt originates from "straight-run" asphalt that is formed from the distillation bottoms in crude oil refining. The DA asphalt is produced by solvent extracting remaining oil from straight-run asphalt.

25 [0014] Depending on the processing method(s) chosen to produce the composition and/or to coat the substrate, the asphalt selected as the barrier-forming material may be of a penetration grade ("pen grade") at 25°C, when tested according to ASTM method D 5, of about 0.5 to about 30, alternatively about 1 to about 20, or about 3 to about 15 (all at 25°C). Similarly, it may be desirable that the selected asphalt has a softening point of about 62°C to about 95°C.

[0015] The asphalt content may be varied in an inverse manner with respect to the other components along similar guideline, i.e., the asphalt content must not be so high that the

composition cannot be processed, nor so low that it cannot provide a film or layer in the desired application. As an example, the total asphalt in the composition may be an amount of about 85wt% to about 15wt% or about 70wt% to about 50wt% of the composition or about 60wt% to about 65wt% of the composition.

5 [0016] The composition also contains a polymer, copolymer or polymer blend (hereinafter, referred to collectively as "polymer" or "polymers") that is not a polyol. Any polymer that fits this definition and is capable of altering the asphalt's viscoelastic properties, however incrementally, may be used. For example, the selected polymer may be capable of increasing the bitumen's plasticity range, i.e., the difference between the
10 material's softening point and its failure point, of improving the material's elastic restoration, and/or of increasing the material's ductility.

[0017] Suitable polymer(s) may include a natural rubber, a synthetic rubber, a thermoplastic rubber, a styrene butadiene styrene (SBS), an ethylene vinyl acetate (EVA), a thermosetting polymer, a thermoplastic polymer, an acrylic polymer, a polyurethane
15 polymer, a styrenated-acrylic polymer, a duroplastic resin, a styrene/butadiene copolymer, an EPDM copolymer, atactic polypropylene and mixtures thereof. Polymers based on (meth)acrylic acid esters, particularly polymers of alkylmethacrylic acid esters (PAMAs) may also be used. Other polymers include those described in, for example, German Patent No. 25 09 473, Japan Patent No. 52-141,829, and PCT application No. 88/07 067.

20 [0018] The polymer may be added directly to the composition. Alternatively, pre-made asphalt/polymer blends ("polymer modified bitumens") may be used. Polymer-modified bitumens available commercially include CARABIT (styrene-butadiene modified, available from Shell Chemical), OLEXOBIT (EPDM modified, available from British Petroleum),
25 STYREL (styrene-butadiene modified, available from Elf). Other suitable polymer modified bitumen include, for example, those disclosed in U.S. Pat. No. 2,420,082, U.S. Pat. No. 2,848,429, Ger. AS 12 40 773, and 23 31 727.

[0019] The polymer may be present in the composition in any amount sufficient to
30 modify the bitumen's properties, as desired. For example, it may be present in the composition in an amount of no greater than about 50%, no greater than about 40%, no greater than about 30%, no greater than about 20%, no greater than about 15%, no greater than about 10%, no greater than about 7%, no greater than about 5%, and/or no greater than about 3% by weight of the total composition.

[0020] In one embodiment, the polymer is present in an amount of about 3.5% to about 15% by weight of the total composition, or about 5% to about 12% by weight of the total composition.

5 [0021] The composition also includes a polyol. The polyol may be any known or to be developed in the art, although it may be preferred that the polyol is in a liquid state at room temperature and/or that the polyol has a molecular weight of about 500 to about 7000, or about 1000 to about 5000. Suitable polyols may include a monomeric polyol, a polyether polyol, a natural polyol, a polyester polyol, pentaerythritol, ethylene glycol, glycerin, polyethylene glycol, polypropylene glycol, and poly(tetramethylene ether) glycol,
10 polypropylene glycol, polyethylene nonyl phenol, and hydroxyl-terminated polybutadiene and mixture thereof. Polyols may be obtained from, for example, Carpenter Co., Dow Chemicals, Huntsman, Bayer, BASF, SKC etc.

[0022] It has been discovered that one may achieve a composition that has the desired processing and end product flexibility, by which is easier to compound and cost effective
15 when the polyol is included in the composition in an amount of no greater than about 30% by weight of the of the total composition. In some circumstances, it may be desirable that the polyol is included in an amount of no greater than 25%, no greater than 20%, no greater than 17%, no greater than 15%, no greater than 10%, no greater than 7%, no greater than 5%, no greater than 3%, no greater than 2%, and/or no greater than 1% by weight of the
20 total composition (prior to curing).

[0023] In an embodiment, the composition does not contain (that is, specifically omits) and/or is substantially free of one or both of a plasticizer and a surface active agent (surfactant). Additionally, or alternately, the composition does not contain an aromatic oil (i.e., it is substantially free of aromatic oils). However, in some embodiments, these
25 materials may be present, as well as other additives and components.

[0024] For example, the composition may include emulsifiers. Suitable emulsifiers may include sodium pyrophosphate (tetrasodium pyrophosphate) and natural or synthetic organic emulsifiers such as tall oil resin, rosins, wood-derived resins, either chemically reacted or unreacted. Examples may include, for example, the wood resin sold as VINSOL®, derived
30 from a pine wood resin material and UNITOL®, a tall oil resin having --COOH functionality.

[0025] In one embodiment, the composition may include a mixture of wood resin and tall oil resin in a weight ratio of wood resin to tall oil resin of about 14:1 to about 27.5:1. In those embodiments which include wood resins and/or tall oil emulsifiers it may be desirable

to include a dilute aqueous hydroxide solution, such as an hydroxide of potassium, sodium, lithium, and/or organic amines.

5 [0026] Another additive that may be included is talc, limestone, carbon, silica or glass fibers, depending on the end use of the materials. Any talc may be used, although talc of mesh values of about 200 to about 400 may be preferred. Therefore, any materials having similar functionality may also be used, such as, for example, precipitated silica, especially with high BET surface areas.

10 [0027] Other additives may include fillers (such as fibers, balls or nanotubes, ground or particularized polymers, etc.), clays and other minerals (ground or otherwise particularized), pebbles, fiberglass, wood pulp, ground rubber, amidoamines, ethyleneamines, such as, e.g., diethylenetriamine, triethylenetetramine, tetraethylenepentamine, aminoethylpiperazine, adhesives, anti-strippers, dispersants, resins. Any additive or combination of additives may be used. However, in some embodiments it may be desirable to exclude any additive that has a plasticizer function, a surface active agent function, and/or an oil.

15 [0028] Other additives that may be incorporated into the composition include, for example, pigments and colorants, opacifiers, scents, biocidal agents, texturizing agents, desiccants and stabilizers.

[0029] The hot-melt blend may be prepared using typical melting process. Polyol may be added in the premix stage, preferably, or in letdown stage. For example, one may first
20 combine the polyol and asphalt (or use a commercial asphalt-polyol blend), then combine the asphalt-polyol blend with the remaining components. Alternatively, the components may be combined simultaneously. Mixing may occur in a horizontal tank with agitation or in a vertical mixing tank. Mixing may be mechanical and chemical/heat facilitated. For example, a precursor blend may be prepared by mechanical mixing or compounding. The
25 precursor blend may then be melt mixed (mixed while under heat) to form the composition, which itself may then be applied to a substrate to form a coating or layer as described below. As is known to a person of skill in the art, care must be taken in preparing such mixtures with particular attention paid to the flash point of the materials involved and the temperature at which the process is carried out and all safeguards and precautions must be
30 observed.

[0030] The composition is prepared and applied to a substrate or surface to form a coating layer. The substrate may be of any material to which one wishes to apply a coating. Illustration examples are a road bed, asphalt slab, metal substrate, partial metal substrate, iron, steel, metal alloys (nickel, iron, chromium, etc), concrete, ceramic, plastic, or polymer.

The substrate may be in any format, including vessels, pipes, slabs, boards, tiles, and may possess any geometry, e.g., arcuate, planar, corrugated planar, spherical, etc. The coating layer may be continuous or discontinuous. If the substrate takes the format of a pipe, either the interior surface of the pipe, the exterior surface of the pipe, or both, may be coated.

- 5 [0031] The composition is applied to the substrate and cured, thereby forming a coating layer. Application may be accomplished by any means in the art.

[0032] The compositions of the invention (1, 2 & 3) were prepared by incorporating the components as shown below in Table 1 (all amounts shown are percent by weight of the total composition):

10

Table 1

Component	1	2	3
Asphalt	60	55	61.55
Styrene-Butadiene-Styrene polymer	5.8	5	4.8
Limestone (pulverized)	33.2	38.2	31.65
Polyol [CARPOL GP 3008] a polyol polyether	1	1.8	2
TOTAL	100	100	100

[0033] A comparative composition (c1) was also prepared containing: asphalt in an amount of 68.1 wt%, Styrene-Butadiene-Styrene polymer in an amount of 6.83 wt%, limestone (pulverized) in an amount of 25.05 wt %, and no polyol component.

- 15 [0034] Each composition 1, 2 & 3 exhibits improved processability relative to the comparative composition c1.

Example II

[0035] The compositions of the invention (4, 5 & 6) were prepared by incorporating the components as shown below in Table 2 (all amounts shown are percent by weight of the

- 20 total composition):

Table 2

Component	4	5	6
Asphalt	78.76	78.76	78.76
Styrene-Butadiene-Styrene polymer 1 (a liner SBS polymer)	5.74	4.74	2.74
Styrene-Butadiene-Styrene polymer 1 (a radial SBS polymer)	9.96	8.96	6.96
Oil	0	0	0
Polyol [CARPOL GP 3008] a polyol polyether	5.54	7.54	11.54
TOTAL	100	100	100

- [0036]** A comparative composition (c2) was also prepared containing: asphalt in an amount of 78.76wt%, Styrene-Butadiene-Styrene polymer 1 in an amount of 5.74wt%, Styrene-Butadiene-Styrene polymer 2 in an amount of 9.96 by weight, oil in amount of 5.54 % by weight, and no polyol (0%).

[0037] Each composition 4, 5, and 6 exhibits improved processability relative to the comparative composition c2.

Example III

- [0038]** The ingredients of Table 1 are heated and mechanically compounded together. The resultant blend is poured into a lined box in a shape resembling a brick. The boxes are closed and packaged. Several bricks are delivered to a road construction project. The bricks are loaded in a hot melt mixer (melter), heated to approximately, 375°F to 400°F and mixed for about 10 to 15 minutes, until viscosity (qualitatively assessed) resembles a thick syrup. The composition is then coated onto the roadbed and permitted to cure.

- [0039]** It will be appreciated by those skilled in the art that changes could be made to the embodiments described above without departing from the broad inventive concept thereof. It is understood, therefore, that this invention is not limited to the particular embodiments disclosed, but it is intended to cover modifications within the spirit and scope of the present invention as defined by the appended claims.

CLAIMS

What is claimed is:

1. A composition to coat a substrate comprising a hot melt blend of:
 - a. an asphalt material, wherein the total amount of asphalt in the composition is between 50 wt% and 85 wt% and the asphalt material is a de-asphaltized-grade asphalt;
 - b. a polymer that is not a polyol; and
 - c. a polyol;

wherein the polyol is present in an amount no greater than 30% by weight of the total composition, and the polyol has a molecular weight of 1000 to 5000 or is selected from the product of a pentaerythritol, ethylene glycol, glycerin, polyethylene glycol, polypropylene glycol, poly(tetramethylene ether) glycol, polypropylene glycol, polyethylene nonyl phenol, and hydroxylterminated polybutadiene.

2. The composition of claim 1, wherein the composition does not contain at least one of a plasticizer and a surface active agent.

3. The composition of claim 1, wherein the polyol is present in an amount no greater than 10% by weight of the total composition.

4. The composition of claim 1, wherein the polyol is present in an amount no greater than 7% by weight of the total composition.

5. The composition of any of claim 1, wherein the polyol is present in an amount no greater than 5% by weight of the total composition.

6. The composition of claim 1, wherein the polyol is present in an amount no greater than 3% by weight of the total composition.

7. The composition of claim 1, wherein the polyol is chosen from a monomeric polyol, a

polyether polyol, a natural polyol, a polyester polyol and mixtures thereof

8. The composition of claim 1, wherein the polymer is chosen from a natural rubber, a synthetic rubber, a thermoplastic rubber, a styrene butadiene styrene (SBS), an ethylene vinyl acetate (EVA), a thermosetting polymer, a thermoplastic polymer, an acrylic polymer, a polyurethane polymer, a styrenated-acrylic polymer, a duroplastic resin, a styrene/butadiene copolymer, an EPDM copolymer, atactic polypropylene and mixtures thereof.

9. The composition of claim 1, wherein the polymer is present in the composition in an amount of no greater than 40% by weight.

10. The composition of claim 1, wherein the polymer is present in the composition in an amount of no greater than 30% by weight.

11. The composition of claim 1, wherein the polymer is present in the composition in an amount of no greater than 20% by weight.

12. The composition of claim 1, wherein the polymer is present in the composition in an amount of no greater than 10% by weight.

13. The composition of claim 1, wherein the polymer is present in the composition in an amount of no greater than 5% by weight.

14. The composition of claim 1, wherein the polymer is present in the composition in an amount of no greater than 50% by weight.

15. The composition of claim 1, further comprising a filler.

16. The composition of claim 15, wherein the filler is chosen from bentonite, laponite, saponite, nontronite, montmorillonite, and a titanate compound.

17. The composition of claims 1, wherein the substrate is chosen from a road bed and a building material.

18. A coated article comprising a substrate coated with a coating layer, wherein the coating layer is formed from a composition that comprises a hot melt blend of:

- a. an asphalt material, wherein the total amount of asphalt in the composition is between 50 wt% and 85 wt% and the asphalt material is a de-asphaltized-grade asphalt,
- b. a polymer that is not a polyol; and
- c. a polyol,

wherein the polyol is present in an amount no greater than 30% by weight of the total composition, and the polyol has a molecular weight of 1000 to 5000 or is selected from the product of a pentaerythritol, ethylene glycol, glycerin, polyethylene glycol, polypropylene glycol, poly(tetramethylene ether) glycol, polypropylene glycol, polyethylene nonyl phenol, and hydroxylterminated polybutadiene.

19. The coated article of claim 18, wherein the polyol of the composition is chosen from a monomeric polyol, a polyether polyol, a natural polyol, a polyester polyol and mixtures thereof.

20. The coated article of claim 18, wherein the polymer of the composition is chosen from a natural rubber, a synthetic rubber, a thermoplastic rubber, a styrene butadiene styrene (SBS), an ethylene vinyl acetate (EVA), a thermosetting polymer, a thermoplastic polymer, an acrylic polymer, a polyurethane polymer, a styrenated-acrylic polymer, a duroplastic resin, a styrene/butadiene copolymer, an EPDM copolymer, atactic polypropylene and mixtures thereof.

21. The coated article of claim 18, wherein the polymer of the composition is present in the composition in an amount of no greater than 40% by weight.

22. A method of improving the processability of an asphalt material comprising combining together an asphalt material, a polymer that is not a polyol, and a polyol, wherein the resultant composition exhibits improved processability as compared to an asphalt composition that does not contain a polyol.

23. The method of claim 22, wherein the polyol is present in the resultant composition in an amount of no greater than 30% by weight.

24. The method of claim 22, wherein the polyol has a molecular weight of 1000 to 5000.

25. The method of claim 22, wherein the resultant composition does not contain at least one of a plasticizer and a surface active agent.

26. A method of improving flexibility at temperatures below 0°C of a cured asphalt coating comprising combining together an asphalt material, a polymer that is not a polyol, and a polyol in an amount of no greater than 30% by weight and a molecular weight of 1000 to 5000 to form a composition, applying the composition to a substrate and curing the composition to form a coating layer, wherein the coating layer exhibits improved flexibility as compared to an asphalt composition that does not contain a polyol.

27. The method of claim 26, wherein the resultant composition does not contain at least one of a plasticizer and a surface active agent.

28. A method of forming a coating that exhibits increased flexibility, comprising applying the composition of any one of claims 1-17 to a substrate and drying, whereby the coating layer formed exhibits increased flexibility relative to conventional asphalt composition coatings.

29. A road bed or road surface comprising a coating layer formed from the asphalt coating composition of any one of claims 1-17.

30. A building material comprising a coating layer formed from the asphalt coating composition of claim 1.

31. The building material of claim 30, wherein the building material is in the form of a shingle, a roof underlayment, a wall board, a window frame, a board, a door, a building exterior wall, a building interiors wall, and a building wrap.

32. A method of preparing a coating composition comprising (A) combining at least an asphalt material, wherein the total amount of asphalt in the composition is between 50 wt% and 85 wt% and the asphalt material is a de-asphaltized-grade asphalt, a polymer that is not a polyol; and a polyol; wherein the polyol is either (1) a polyol having a molecular weight of 1000 to 5000 or (2) is present in an amount no greater than 30% by weight of the total composition to form a blend composition; (B) hot melting the blend composition to form the coating composition; and

wherein the polymer is chosen from a natural rubber, a synthetic rubber, a thermoplastic rubber, a styrene butadiene styrene (SBS), an ethylene vinyl acetate (EVA), a thermosetting polymer, a thermoplastic polymer, an acrylic polymer, a polyurethane polymer, a styrenated-acrylic polymer, a duroplastic resin, a styrene/butadiene copolymer, an EPDM copolymer, atactic polypropylene and mixtures thereof.

33. The method of claim 32, wherein the composition does not contain at least one of a plasticizer and a surface active agent.

34. The method of claim 32, wherein the polyol is present in an amount no greater than 10% by weight of the total composition.

35. The method of claim 32, wherein the polyol is present in an amount no greater than 7% by weight of the total composition.

36. The method of claim 32, wherein the polyol is present in an amount no greater than 5% by weight of the total composition.

37. The method of claim 32, wherein the polyol is present in an amount no greater than 3% by weight of the total composition.

38. The method of claim 32, wherein the polyol is chosen from a monomeric polyol, a polyether polyol, a natural polyol, a polyester polyol and mixtures thereof.

39. The method of claim 32, wherein the polyol is chosen from a pentaerythritol, ethylene glycol, glycerin, polyethylene glycol, polypropylene glycol, poly(tetramethylene

ether) glycol, polypropylene glycol, polyethylene _nonyl phenol, and hydroxyl-terminated polybutadiene.

40. A process for applying a substantially waterproof coating to a substrate or surface, comprising preparing the asphalt coating composition of claim 1, applying the asphalt coating composition to the surface or substrate and curing, thereby forming a coating layer.

41. The process of claim 32, wherein the application step comprises at least one of spraying, wiping, spreading, painting, and dipping.

42. A process of forming a waterproofing film comprising, preparing the asphalt coating composition of claim 1, applying the asphalt coating composition to a detachable surface and drying, thereby forming a film, and detaching the film from the detachable surface.