Summary

[0006] A continuing goal in the pavement-marking industry is to find economical products from which to form traffic control stripes having a longer useful life and excellent durability. A significant part of forming an improved pavement marking tape involves forming a topcoat with excellent durability. Many attempts to increase the durability of the topcoat have involved increasing the topcoat hardness. However, the inventors of the present disclosure discovered that increasing topcoat hardness alone does not necessarily or on its own create a superior pavement marking tape. For example, if the topcoat is too stiff, the pavement marking tape will not roll up or will crack when it is rolled.

[0007] The inventors of the present disclosure discovered that use of a urea-modified polyurethane coating as the topcoat in a pavement marking tape has numerous advantages. Use of this known type of coating in a pavement marking tape would not have been obvious for a variety of reasons. For example, the use of amines in the topcoat has certain disadvantages including, for example, (1) undesirable cure time and/or cure viscosity profile; and (2) amines directly on certain polymers, such as, for example, polymers containing halogenated compounds, discolors the polymer. However, the inventors of the present disclosure discovered a polurea-modified polyurethane topcoat for use in a pavement marking tape that has acceptable stiffness to achieve optimal topcoat hardness without creating undesirable browning or increased cure time and/or cure viscosity profile. Also, the topcoat demonstrates improved adhesion to the base layer/premix compared to pavement marking topcoats including polyurethanes modified with polyurea linkages formed by the reaction of amines other than polyaspartic ester polyamines. Surprisingly, the inventors of the present disclosure discovered that polymeric topcoats having desirable and useful properties can be obtained using a small molar ratio of the aspartic ester polyamine and a polyol.

[0008] The inventors of the present disclosure also realized that topcoats including aspartic ester polyamines are less dependent on the selection of the polyol in the topcoat. Thus, polymeric topcoats having desirable physical, chemical and mechanical properties can now be made as the reaction product of mixtures comprising any of a large number of commercially available polyols.

[0009] Some embodiments of the present disclosure relate to a pavement marking tape, comprising: a base layer comprising at least one non-crosslinked elastomeric polymer and an extender resin that comprises a halogenated polymer or a halogenated wax; and a topcoat comprising a urea-modified polyurethane that is the reaction product of an aspartic ester polyamine, a polyisocyanate, and a polyol.

[0010] In some embodiments, the aspartic ester polyamine has a molecular weight of at least 460. In some embodiments, the base layer includes at least one non-crosslinked elastomeric polymer. In some embodiments, the non-crosslinked elastomeric polymer is selected from a group consisting of acrylonitrile-butadiene polymers, neoprene, natural rubber, polyacrylates, and styrene-butadiene polymers. In some embodiments, the base layer includes an extender resin that is present between about

10 parts and about 70 parts per 100 parts of non-crosslinked elastomeric polymer. In some embodiments, the extender resin is present in an amount of between about 2% and about 10%. The extender resin can comprise a halogenated polymer or halogenated wax. In some embodiments, the base layer is substantially free of halogenated polymer or halogenated wax.

[0011] Some embodiments of the present disclosure relate to a method of forming a pavement marking tape, comprising: forming a topcoat comprising a reaction product of a mixture comprising (a) a first topcoat component including a polyol and an aspartic ester polyamine; and (b) a second component including a polyisocyanate; and applying the topcoat to a base layer comprising at least one non-crosslinked elastomeric polymer and an extender resin that comprises a halogenated polymer or a halogenated wax.

Brief Description of Drawings

[0012] Fig. 1 is a schematic diagram of an exemplary pavement marking tape in accordance with the present disclosure.

[0013] The figures are not necessarily to scale. Like numbers used in the figures refer to like components. However, it will be understood that the use of a number to refer to a component in a given figure is not intended to limit the component in another figure labeled with the same number.

[0014] In the following detailed description, reference may be made to the accompanying drawing that forms a part hereof and in which is shown by way of illustration one exemplary specific embodiment. It is to be understood that other embodiments are contemplated and may be made without departing from the scope or spirit of the present disclosure.

Detailed Description

[0015] Various embodiments and implementations will be described in detail. These embodiments and implementations should not be construed as limiting the scope of the present application in any manner, and changes and modifications may be made without departing from the spirit and scope of the disclosure. The scope of the present application should be determined solely by the claims.

[0016] Fig. 1 is a schematic diagram of a pavement marking tape 100 in accordance with the present disclosure. Pavement marking tape 100 includes a base layer 110 adjacent to a topcoat layer 120. As shown in Fig. 1, base layer 110 is a substantially flat or planar surface. However, base layer 110 can have other constructions. For example, the base layer can include protrusions that can be, for example, integral with or added to the base layer. Additionally, the protrusions can be sinusoidal or can each independently having a top surface and a side surface. In some embodiments, the protrusions protrude from only one surface of the base layer. In other embodiments, the protrusions extend from both surfaces of the body layer. Where present, the protrusions can have any dimension and can be arranged in any way (including, for example, randomly or in a repeating or regular pattern).

CLAIMS

1. A pavement marking tape, comprising:

a base layer comprising

at least one non-crosslinked elastomeric polymer, and

an extender resin that comprises a halogenated polymer or a halogenated wax; and

a topcoat comprising a urea-modified polyurethane that is the reaction product of an aspartic ester polyamine, a polyisocyanate, and a polyol.

2. The pavement marking tape of claim 1, wherein the aspartic ester polyamine has a molecular weight of at least 460.

3. The pavement marking tape of claim 1, wherein the base layer is substantially free of halogenated polymer.

4. The pavement marking tape of claim 1, wherein the base layer is substantially free of chlorine.

5. The pavement marking tape of claim 1, wherein in the base layer the extender resin is present in an amount of between about 10 and about 70 parts per 100 parts of non-crosslinked elastomeric polymer, by weight.

6. The pavement marking tape of claim 1, wherein the non-crosslinked elastomeric polymer is selected from a group consisting of acrylonitrile-butadiene polymers, neoprene, natural rubber, polyacrylates, and styrene-butadiene polymers.

7. A method of forming a pavement marking tape, comprising:

forming a topcoat comprising a reaction product of a mixture comprising

(a) a first topcoat component comprising a polyol and an aspartic ester polyamine, and

(b) a second component comprising a polyisocyanate; and

applying the topcoat to a base layer comprising

at least one non-crosslinked elastomeric polymer, and

an extender resin that comprises a halogenated polymer or a halogenated wax.

8. The method of claim 7, wherein the aspartic ester polyamine has a molecular weight of at least 460.