Title: CURABLE SEALING METHOD AND BAFFLE COMPOSITION

Abstract: A composition adapted to seal to a substrate is provided. The composition includes a radiation curable rubber, a photoinitiator, a blowing agent, a styrene-isoprene-styrene block copolymer, a plasticizer, and at least one of a radiation curable monomer and radiation curable oligomer.
CURABLE SEALING METHOD AND BAFFLE COMPOSITION

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 60/836,768, filed on August 10, 2006. The disclosure of the above application is incorporated herein by reference.

FIELD

[0002] The present invention relates to a curable sealing method and baffle composition, and more particularly to a curable sealing method and baffle composition for use in automotive, appliance, and other applications.

BACKGROUND OF THE INVENTION

[0003] The statements in this section merely provide background information related to the present disclosure and may or may not constitute prior art.

[0004] In various industries, for example the automotive industry and appliance industry, it is known to apply a hot melt adhesive or a sealant composition to a product or part during the manufacturing process in order to seal seams, provide structural support, and/or provide vibration damping properties. For example, during the assembly of an automobile, hot melt sealants and adhesives are often used within or between the joints between separate components in order to seal the separate components together.

[0005] However, the application of hot melt sealants and adhesives to parts can be labor intensive and costly to install due to the difficulty in positioning the sealants and adhesives relative to the parts. In addition, hot
melt sealants currently in use require heating or exposure to moisture after application in order to properly cure and/or seal to a substrate surface on the part. Where such hot melt sealants are used in automotive applications, the hot melt sealants must be cured by passing the part through an oven to raise the temperature of the sealant and part during the manufacturing process. If the hot melt sealant is not properly cured during the manufacturing process, the sealant may not properly seal or adhere to the part to which it has been applied and/or may be smeared onto adjacent surfaces causing contamination and/or an unsightly appearance.

[0006] Accordingly, there is a need in the art for a curable sealing method and composition which is capable of bonding to substrates and/or sealing seams, which is capable of providing structural support and/or providing vibration damping properties, which may be cured without the need for heat or moisture, which provides effective heat and chemical resistance, and which is cost effective to apply.

SUMMARY OF THE INVENTION

[0007] In one embodiment of the present invention, an article adapted to seal to a substrate is provided.

[0008] In one aspect of the present invention, the article includes a composition comprising a radiation curable rubber, a photoinitiator, a blowing agent, a styrene-isoprene-styrene block copolymer, a plasticizer, and at least one of a radiation curable monomer and radiation curable oligomer. The article also includes a first portion cured by a radiation source and a second portion that expands upon exposure to heat to seal the article to the substrate.
In another aspect of the present invention, the radiation curable rubber comprises a styrene-butadiene-styrene block copolymer.

In still another aspect of the present invention, the radiation curable rubber is curable by ultra-violet radiation.

In still another aspect of the present invention, the blowing agent is selected from the group comprising unexpanded microspheres and activated azodicarbonamide.

In still another aspect of the present invention, the plasticizer is a light mineral oil.

In still another aspect of the present invention, the radiation curable monomer and radiation curable oligomer is a polybutadiene diacrylate.

In another embodiment of the present invention, a composition is provided having from about 10 to 25% by weight of a radiation curable styrene-butadiene-styrene block copolymer, from about 40 to 75% by weight of a mineral oil, from about 10 to 25% of a styrene-isoprene-styrene block copolymer, from about 0.5 to 1.5% by weight of a photoinitiator, from about 0 to 3% of one of a radiation curable monomer and radiation curable oligomer, from about 1 to 6% by weight of at least one of a radiation curable monomer and radiation curable oligomer.

In yet another embodiment of the present invention, a method for sealing a composition to a motor vehicle is provided.

In one aspect of the present invention, the method includes the steps of applying a composition to a substrate, the composition comprising a radiation curable rubber, a photoinitiator, a blowing agent, a...
styrene-isoprene-styrene block copolymer, a plasticizer, a curing agent, and a dye, curing at least a portion of the composition with a radiation source, and heating the composition such that the composition expands and seals to the substrate.

[0017] In another aspect of the present invention, the step of curing the composition includes curing the composition with ultra-violet radiation.

[0018] In yet another aspect of the present invention, the step of curing the composition is accomplished after applying the composition to the substrate.

[0019] In yet another aspect of the present invention, the method includes the step of immersing the substrate and composition within a fluid bath prior to heating the composition.

[0020] In yet another aspect of the present invention, the step of heating the composition includes heating the composition in a paint-bake cycle during assembly of the motor vehicle.

[0021] Further embodiments and aspects of the present invention will be provided from the detailed description of the preferred embodiments provided below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] FIG. 1 is a schematic illustration of one embodiment of a curable sealing baffle composition applied to a substrate according to the principles of the present invention; and

[0023] FIG. 2 is a schematic illustration of one embodiment of the curable sealing baffle composition shown in FIG. 1 sealed to the substrate.
DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] With reference to FIG. 1, an article or baffle is generally indicated by reference number 10. The article 10 is preferably employed to seal a discontinuity or gap between one or more components or exemplary substrates 12. Examples of such discontinuities may include joints, seams, spaces, cavities, holes, etc. These discontinuities are common in many applications. For example, in motor vehicles, many parts or substrates 12 have cavities that must be filled with a baffle in order to reduce vibration and noise, as well as prevent intrusion by water or air. However, these cavities must be allowed to drain after emersion in an e-coat bath that is commonly used in automotive paint-bake cycles and then subsequently sealed by the baffle composition. Additionally, it is common for the substrate 12 to have an uneven surface. Accordingly, the exemplary substrate 12 includes a recessed portion 20 and a drain hole 22.

[0025] The part 10 is comprised of a baffle composition 14. The baffle composition 14 comprises a curable rubber component that is a block copolymer with reactive sites for radiation curing. For example, the curable rubber component may comprise a styrene-butadiene-styrene block copolymer. However, other types of curable rubber components may be employed without departing from the scope of the present invention so long as the curable rubber components have the similar curing properties to the styrene-butadiene-styrene block copolymer. The curable rubber component is curable by a radiation source. In a preferred embodiment of the present invention, the radiation source is ultra-violet (UV) light having a wavelength from about 240 to 450 nm. However, it should be appreciated that any
radiation source may be employed without departing from the scope of the present invention so long as curing of the rubber component is achievable. A preferred UV curable styrenic block copolymer for use in the present invention is Kraton™ KX222, commercially available from Kraton Polymers. However, it should be appreciated that other rubbery or block copolymer materials may be used in the present invention.

[0026] The baffle composition 14 further includes one or more photoinitiators. Suitable photoinitiators for use include, but are not limited to, benzophenones, acetophenone derivatives, such as alpha-hydroxyalkylphenylketones, benzoin alkyl ethers and benzil ketals, monoacrylphosphine oxides, and bisacylphosphine oxides. For example, specific photoinitiators include 1-hydroxycyclohexyl phenylketone (Irgacure® 184, Ciba Geigy; or Benacure®, Mayzo), Irgacure 819 (bis (2,4,6-thmethylbenzoyl)-phenyl phosphine-oxide, Ciba Geigy), and Genocure CPK (Rahn). Chemical derivatives and combinations of these photoinitiators can also be employed without departing from the scope of the present invention.

[0027] The photoinitiator is employed to help control the degree of curing for a given source of radiation. Accordingly, the photoinitiator in the baffle composition is present in an amount sufficient to provide a desired cure speed, good surface and through cure, and a lack of yellowing upon aging.

[0028] The baffle composition 14 may also include a blowing agent that is employed to assist the baffle composition to expand upon heating. Examples of preferred blowing agents include, but are not limited to, unexpanded microspheres and activated azodicarbonamide.
The baffle composition 14 may also include a styrene-isoprene-styrene block copolymer, a plasticizer such as mineral oil, a radiation curable monomer or radiation curable oligomer, and a pigment or dye. The radiation curable monomer or oligomer is preferably a polybutadiene diacrylate, though various other radiation curable monomers and oligomers may be employed.

Finally, the baffle composition 14 may also include a number of conventional additives including, but not limited to, heat stabilizers, adhesion promoters, fillers, antioxidants, rheology modifiers, wetting agents, and the like. For example, a preferred heat stabilizer is Irganox 1010, available from Ciba Geigy, a preferred rheology modifier is fumed silica (Aerosil 200, available from Degussa), and a preferred adhesion promoter is a polyamide resin.

In a preferred embodiment of the present invention, the baffle composition includes from about 10 to 25% by weight of the styrene-butadiene-styrene block copolymer, from about 40 to 75% by weight mineral oil, from about 10 to 25% of a styrene-isoprene-styrene block copolymer, from about 0.5 to 1.5% by weight of a photoinitiator, from about 0 to 3% of the radiation curable monomer or oligomer, and from about 1 to 6% by weight of a blowing agent.

In order that the invention may be more readily understood, reference is made to the following examples which are intended to illustrate the invention, but not limit the scope thereof:
### Baffle Composition - Example 1

<table>
<thead>
<tr>
<th>Component</th>
<th>Percent by Weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV curable SBS rubber†</td>
<td>16</td>
</tr>
<tr>
<td>light mineral oil†</td>
<td>58</td>
</tr>
<tr>
<td>styrene-isoprene-styrene block copolymer†</td>
<td>16</td>
</tr>
<tr>
<td>carbon black†</td>
<td>1</td>
</tr>
<tr>
<td>photoinitiator†</td>
<td>0.7</td>
</tr>
<tr>
<td>polybutadiene diacrylate†</td>
<td>2.5</td>
</tr>
<tr>
<td>blowing agent†</td>
<td>5.8</td>
</tr>
</tbody>
</table>

1. Kraton™ KX222 (Kraton Polymers)
2. NP-22 (Eastern Oil)
3. Kraton 1163P (Kraton Polymers)
4. Elftex 8 (Cabot)
5. Irgacure 819 (Ciba Geigy)
6. Sartomer CN307 (Sartomer)
7. Expancel DU (Akzo Nobel)

### Baffle Composition - Example 2

<table>
<thead>
<tr>
<th>Component</th>
<th>Percent by Weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV curable SBS rubber†</td>
<td>16</td>
</tr>
<tr>
<td>light mineral oil†</td>
<td>60</td>
</tr>
<tr>
<td>styrene-isoprene-styrene block copolymer†</td>
<td>16</td>
</tr>
<tr>
<td>carbon black†</td>
<td>1</td>
</tr>
<tr>
<td>photoinitiator†</td>
<td>0.7</td>
</tr>
<tr>
<td>polybutadiene diacrylate†</td>
<td>2</td>
</tr>
<tr>
<td>activated azodicarbonamide†</td>
<td>4.3</td>
</tr>
</tbody>
</table>

1. Kraton™ KX222 (Kraton Polymers)
2. NP-22 (Eastern Oil)
3. Kraton 1163P (Kraton Polymers)
4. Elftex 8 (Cabot)
5. Irgacure 819 (Ciba)
6. Sartomer CN307 (Sartomer)
7. Celogen 725B (Chemtura)

[0033] The baffle composition 14 is preferably prepared by mixing all of the components using a C-blade or Sigma blade mixer, though other methods of mixing the components may be employed. The baffle composition 14 is preferably applied to the substrate 12 either as an extruded sheet or in a
heat-softened or hot melt state. Various methods may be employed to apply
the composition 14 to the substrate 12 in a hot melt state including, but not
limited to, employing a hot melt apparatus such as a hot melt applicator or roll
coater. The baffle composition 14 placed within the substrate 12 such that
drain hole 22 is not sealed by the article 10.

[0034] The baffle composition 14 is then preferably allowed to cool
in place and is then cured using a radiation source. Selected areas or
portions 16 of the baffle composition 14 are preferably cured in order to
control the expansion of the composition 14 during a subsequent heating.
Upon curing, the portion 16 is made rigid and hard and keeps the uncured
portion 18 from moving. In applications which require soft foams or
controllable expansion, the baffle composition 14 can be tailored to control the
cure of the article 10 prior to expansion. The radiation source, as noted
above, may include UV or near-UV radiation from a UV light such as a UV
lamp. However, it should be appreciated that other radiation curing sources
may be used to cure the baffle composition as long as the desired cure is
achieved.

[0035] The composition 14 is preferably somewhat transparent to
the radiation source such that a large amount of material is cured. As noted
above, this curing creates a stiff or hard shell portion 16 on one side of the
article 10 that will hold the article 10 in shape. This allows the simple forming
of parts and shapes from the initial flat extruded sheet or hot melt application.

[0036] Next, in the case of a substrate 12 used in a motor vehicle,
the substrate 12 and the baffle composition 14 is then immersed in an e-
coating bath and then removed. Excess fluid is able to drain through the drain
hole 22 since the baffle composition 14 has not yet been sealed to the substrate 12. Then the substrate 12 and baffle composition 14 is heated which causes the uncured or slightly cured portion 18 of the baffle composition 14 to flow and expand against the cured portion 16 in a direction away from the cured portion 16. This expansion of the uncured portion 18 allows the article 10 to seal against the recess 20 and seal the drain hole 22. In automotive applications, the step of heating the substrate 12 typically includes heating the substrate 12 as part of a paint bake process where an automotive part is primed and/or painted, and then passed through a paint bake oven which is used to cure the painted part.

[0037] The baffle composition 14 offers an advantage over prior art moisture cure polymers which are typically used for this application and which must be cured for 4 hours or more and may include more than one piece. The baffle composition of the present invention may be cured very quickly and provides immediate strength once cured.

[0038] The description of the invention is merely exemplary in nature and variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.
CLAIMS

1. An article adapted to seal to a substrate, the article comprising:
   a composition comprising a radiation curable rubber, a photoinitiator, a
   blowing agent, a styrene-isoprene-styrene block copolymer, a plasticizer, and
   at least one of a radiation curable monomer and radiation curable oligomer;
   a first portion cured by a radiation source; and
   a second portion that expands upon exposure to heat to seal the article
   to the substrate.

2. The article of claim 1 wherein the radiation curable rubber
   comprises a styrene-butadiene-styrene block copolymer.

3. The article of claim 2 wherein the radiation curable rubber is
   curable by ultra-violet radiation.

4. The article of claim 3 wherein the blowing agent is selected from
   the group comprising unexpanded microspheres and activated
   azodicarbonamide.

5. The article of claim 4 wherein the plasticizer is a light mineral oil.

6. The article of claim 5 wherein the radiation curable monomer
   and radiation curable oligomer is a polybutadiene diacrylate.
7. A composition adapted to seal to a substrate, the composition comprising:

from about 10 to 25% by weight of a radiation curable styrene-butadiene-styrene block copolymer, from about 40 to 75% by weight of a mineral oil, from about 10 to 25% of a styrene-isoprene-styrene block copolymer, from about 0.5 to 1.5% by weight of a photoinitiator, from about 0 to 3% of one of a radiation curable monomer and radiation curable oligomer, from about 1 to 6% by weight of a blowing agent, and about 1% by weight of a pigment.
8. A method for sealing a composition to a motor vehicle comprising the steps of:

applying a composition to a substrate, the composition comprising a radiation curable rubber, a photoinitiator, a blowing agent, a styrene-isoprene-styrene block copolymer, a plasticizer, and at least one of a radiation curable monomer and radiation curable oligomer;

curing at least a portion of the composition with a radiation source; and

heating the composition such that the composition expands and seals to the substrate.

9. The method of claim 8 wherein the step of curing the composition includes curing the composition with ultra-violet radiation.

10. The method of claim 8 wherein the step of curing the composition is accomplished after applying the composition to the substrate.

11. The method of claim 8 further comprising immersing the substrate and composition within a fluid bath prior to heating the composition.

12. The method of claim 8 wherein the step of heating the composition includes heating the composition in a paint-bake cycle during assembly of the motor vehicle.