Claims

What is claimed is:

1. An adhesive formulation comprising:

50 to 99% adhesive component;

0 to 3% crosslinker;

0 to 3% antioxidant; and

0.1 to 10% expandable microspheres dispersed throughout the formulation.

2. The adhesive formulation of claim 1 further comprising from 0.1 to 30% of at least one agent selected from the group consisting of fillers, pigments, plasticizers, flame retardants, UV stabilizers, and combinations thereof.

3. The adhesive formulation of any one of claims 1-2 further comprising from 0.1 to 40% tackifier.

4. The adhesive formulation of any one of claims 1-3 wherein the microspheres include thermoplastic polymeric shells encapsulating gas filled hollow interior cores.

5. The adhesive formulation of any one of claims 1-4 wherein the microspheres have a size prior to expansion within a range of from 5 μm to 75 μm.

6. The adhesive formulation of any one of claims 1-5 wherein the microspheres expand upon exposure to a temperature within a range of from 70° C to 220° C.

7. The adhesive formulation of any one of claims 1-6 wherein the microspheres exhibit a nonrupture temperature within a range of from 120° C to 210° C.

8 The adhesive formulation of any one of claims 1-7 wherein the microspheres are in an unexpanded state.

9. The adhesive formulation of any one of claims 1-7 wherein the microspheres are in an expanded state.

10. The adhesive formulation of claim 9 wherein the microspheres have a size after expansion within a range of from 10 µm to 200 µm.

11. The adhesive formulation of any one of claims 1-10 comprising:

65 to 75% of the adhesive component;

25 to 35% of the tackifier;

0.1 to 1% of the crosslinker;

0.25 to 1% of the antioxidant; and

1.5 to 4% of the microspheres.

12. A layered adhesive assembly comprising:

a film; and

a layer of adhesive disposed on the film, the adhesive including 50 to 99% adhesive component, 0 to 3% crosslinker, 0 to 3% antioxidant, and 0.1 to 10% expandable microspheres dispersed throughout the formulation.

13. The layered adhesive assembly of claim 12 wherein the adhesive further includes from 0.1 to 30% of at least one agent selected from the group consisting of fillers, pigments, plasticizers, flame retardants, UV stabilizers, and combinations thereof.

14. The layered adhesive assembly of any one of claims 12-13 wherein the adhesive further includes 0.1 to 40% tackifier.

15. The layered adhesive assembly of any one of claims 12-14 wherein the microspheres include thermoplastic polymeric shells encapsulating gas filled hollow interior cores.

16. The layered adhesive assembly of any one of claims 12-15 wherein the microspheres have a size prior to expansion within a range of from 5 μm to 75 μm.

17. The layered adhesive assembly of any one of claims 12-16 wherein the microspheres expand upon exposure to a temperature within a range of from 70° C to 220° C.

18. The layered adhesive assembly of any one of claims 12-17 wherein the microspheres exhibit a nonrupture temperature within a range of from 120° C to 210° C.

19. The layered adhesive assembly of any one of claims 12-18 wherein the microspheres are in an unexpanded state.

20. The layered assembly of any one of claims 12-18 wherein the microspheres are in an expanded state.

21. The layered assembly of claim 20 wherein the microspheres have a size after expansion within a range of from 10 µm to 200 µm.

22. The layered assembly of any one of claims 12-21 wherein the adhesive formulation includes 65 to 75% of the adhesive component, 25 to 35% of the tackifier, 0.1 to 1% of the crosslinker, 0.25 to 1% of the antioxidant, and 1.5 to 4% of the microspheres.

23. The layered assembly of any one of claims 12-22 wherein the layer of adhesive is a first layer, the assembly further comprising a second layer of adhesive.

24. The layered assembly of claim 23 wherein the second layer of adhesive is disposed on a face of the film opposite the face of the film upon which is dispersed the first layer of adhesive.

25. The layered assembly of any one of claims 23-24 wherein the second layer of adhesive includes 50 to 99% adhesive component, 0 to 3% crosslinker, 0 to 3% antioxidant, and 0.1 to 10% expandable microspheres dispersed throughout the formulation.

26. The layered assembly of claim 25 wherein the second layer of adhesive further includes 0.1 to 10% tackifier.

27. A method of absorbing mechanical shocks to a component affixed to a substrate, the method comprising:

providing a layer of adhesive including 50 to 99% adhesive component, 0 to 3% crosslinker, 0 to 3% antioxidant, and 0.1 to 10% expandable microspheres dispersed throughout the formulation;

disposing the layer of the adhesive between the component and the substrate.

28. The method of claim 27 further comprising:

expanding the microspheres dispersed throughout the formulation.

29. The method of any one of claims 27-28 wherein the layer of the adhesive contacts the component.

30. The method of any one of claims 27-29 wherein the layer of the adhesive contacts the substrate.

31. A layered adhesive assembly comprising:

a first and second skin layer of adhesive,

a core layer ofadhesive, the adhesive including 50 to 99% adhesive component, 0 to 5% crosslinker, 0 to 3% antioxidant, and 0.1 to 10% expandable microspheres dispersed throughout the formulation.

32. The layered adhesive assembly of claim 31 wherein the core layer of adhesive further includes from 0.1 to 30% of at least one agent selected from the group consisting of fillers, pigments, plasticizers, flame retardants, UV stabilizers, and combinations thereof.

33. The layered adhesive assembly of any one of claims 31-32 wherein the core layer of adhesive further includes 0.1 to 40% tackifier.

34. The layered adhesive assembly of any one of claims 31-33 wherein the microspheres include thermoplastic polymeric shells encapsulating gas filled hollow interior cores.

35. The layered adhesive assembly of any one of claims 31-34 wherein the microspheres have a size prior to expansion within a range of from 5 μm to 75 μm.

36. The layered adhesive assembly of any one of claims 31-35 wherein the microspheres expand upon exposure to a temperature within a range of from 70° C to 220° C.

37. The layered adhesive assembly of any one of claims 31-36 wherein the microspheres exhibit a nonrupture temperature within a range of from 120° C to 210° C.

38. The layered adhesive assembly of any one of claims 31-37 wherein the microspheres are in an unexpanded state.

39. The layered assembly of any one of claims 31-38 wherein the microspheres are in an expanded state.

40. The layered assembly of claim 39 wherein the microspheres have a size after expansion within a range of from 10 µm to 200 µm.

41. The layered assembly of any one of claims 31-40 wherein the adhesive formulation includes 65 to 75% of the adhesive component, 25 to 40% of the tackifier, 0.1 to 5% of the crosslinker, 0.25 to 3% of the antioxidant, and 1.5 to 5% of the microspheres.

42. The layered assembly of claim 41 wherein the first and second skin layers of adhesive aredisposed on the first and second face of the core adhesive layer.

43. The layered assembly of any one of claims 31-42, wherein the core adhesive layer comprises a rubber adhesive component.

44. The layered assembly of any one of claims 31-42, wherein each of the skin layers comprise a rubber adhesive component.

45. The layered assembly of any one of claims 31-44, wherein the core adhesive layer is from 10-175 µm.

46. The layered assembly of any one of claims 31-45, wherein each skin layer is from 10-125 µm.

47. The layered assembly of any one of claims 31-46, wherein the first and second skin layers are the same composition.

CLAIMS

1. An adhesive formulation comprising:

50 to 99% adhesive component;

0 to 3% crosslinker;

0 to 3% antioxidant; and

0.1 to 10% expandable microspheres dispersed throughout the formulation.

2. The adhesive formulation of claim 1 further comprising from 0.1 to 30% of at least one agent selected from the group consisting of fillers, pigments, plasticizers, flame retardants, UV stabilizers, and combinations thereof.

3. The adhesive formulation of claim 1 further comprising from 0.1 to 40% tackifier.

4. The adhesive formulation of claim 1 wherein the microspheres include thermoplastic polymeric shells encapsulating gas filled hollow interior cores.

5. The adhesive formulation of claim 1 wherein the microspheres have a size prior to expansion within a range of from 5 μm to 75 μm.

6. The adhesive formulation of claim 1 wherein the microspheres expand upon exposure to a temperature within a range of from 70° C to 220° C.

7. The adhesive formulation of claim 1 wherein the microspheres exhibit a nonrupture temperature within a range of from 120° C to 210° C.

8. The adhesive formulation of claim 1 wherein the microspheres are in an unexpanded state.

9. The adhesive formulation of claim 1 wherein the microspheres are in an expanded state.

10. The adhesive formulation of claim 9 wherein the microspheres have a size after expansion within a range of from 10 μm to 200 μm.

11. The adhesive formulation of claim 1 comprising:

65 to 75% of the adhesive component;

25 to 35% of the tackifier;

0.1 to 1% of the crosslinker;

0.25 to 1% of the antioxidant; and

1.5 to 4% of the microspheres.

12. A layered adhesive assembly comprising:

a film; and

a layer of adhesive disposed on the film, the adhesive including 50 to 99% adhesive component, 0 to 3% crosslinker, 0 to 3% antioxidant, and 0.1 to 10% expandable microspheres dispersed throughout the formulation.

13. The layered adhesive assembly of claim 12 wherein the adhesive further includes from 0.1 to 30% of at least one agent selected from the group consisting of fillers, pigments, plasticizers, flame retardants, UV stabilizers, and combinations thereof.

14. The layered adhesive assembly of claim 12 wherein the adhesive further includes 0.1 to 40% tackifier.

15. The layered adhesive assembly of claim 12 wherein the microspheres include thermoplastic polymeric shells encapsulating gas filled hollow interior cores.

16. The layered adhesive assembly of claim 12 wherein the microspheres have a size prior to expansion within a range of from 5 μm to 75 μm.

17. The layered adhesive assembly of claim 12 wherein the microspheres expand upon exposure to a temperature within a range of from 70° C to 220° C.

18. The layered adhesive assembly of claim 12 wherein the microspheres exhibit a nonrupture temperature within a range of from 120° C to 210° C.

19. The layered adhesive assembly of claim 12 wherein the microspheres are in an unexpanded state.

20. The layered adhesive assembly of claim 12 wherein the microspheres are in an expanded state.

21. The layered adhesive assembly of claim 20 wherein the microspheres have a size after expansion within a range of from 10 μm to 200 μm.

22. The layered adhesive assembly of claim 12 wherein the adhesive formulation includes 65 to 75% of the adhesive component, 25 to 35% of the tackifier, 0.1 to 1% of the crosslinker, 0.25 to 1% of the antioxidant, and 1.5 to 4% of the microspheres.

23. The layered adhesive assembly of claim 12 wherein the layer of adhesive is a first layer, the assembly further comprising a second layer of adhesive.

24. The layered adhesive assembly of claim 23 wherein the second layer of adhesive is disposed on a face of the film opposite the face of the film upon which is dispersed the first layer of adhesive.

25. The layered adhesive assembly of claim 23 wherein the second layer of adhesive includes 50 to 99% adhesive component, 0 to 3% crosslinker, 0 to 3% antioxidant, and 0.1 to 10% expandable microspheres dispersed throughout the formulation.

26. The layered adhesive assembly of claim 25 wherein the second layer of adhesive further includes 0.1 to 40% tackifier.

27. A method of absorbing mechanical shocks to a component affixed to a substrate, the method comprising:

providing a layer of adhesive including 50 to 99% adhesive component, 0 to 3% crosslinker, 0 to 3% antioxidant, and 0.1 to 10% expandable microspheres dispersed throughout the formulation;

disposing the layer of the adhesive between the component and the substrate.

28. The method of claim 27 further comprising:

expanding the microspheres dispersed throughout the formulation.

29. The method of any one of claims 27-28 wherein the layer of the adhesive contacts the component.

30. The method of any one of claims 27-29 wherein the layer of the adhesive contacts the substrate.

31. A layered adhesive assembly comprising:

a first and second skin layer of adhesive,

a core layer of adhesive, the adhesive including 50 to 99% adhesive component, 0 to 5% crosslinker, 0 to 3% antioxidant, and 0.1 to 10% expandable microspheres dispersed throughout the formulation.

32. The layered adhesive assembly of claim 31 wherein the core layer of adhesive further includes from 0.1 to 30% of at least one agent selected from the group consisting of fillers, pigments, plasticizers, flame retardants, UV stabilizers, and combinations thereof.

33. The layered adhesive assembly of claim 31 wherein the core layer of adhesive further includes 0.1 to 40% tackifier.

34. The layered adhesive assembly of claim 31 wherein the microspheres include thermoplastic polymeric shells encapsulating gas filled hollow interior cores.

35. The layered adhesive assembly of claim 31 wherein the microspheres have a size prior to expansion within a range of from 5 μm to 75 μm.

36. The layered adhesive assembly of claim 31 wherein the microspheres expand upon exposure to a temperature within a range of from 70° C to 220° C.

37. The layered adhesive assembly of claim 31 wherein the microspheres exhibit a nonrupture temperature within a range of from 120° C to 210° C.

38. The layered adhesive assembly of claim 31 wherein the microspheres are in an unexpanded state.

39. The layered adhesive assembly of claim 31 wherein the microspheres are in an expanded state.

40. The layered adhesive assembly of claim 39 wherein the microspheres have a size after expansion within a range of from 10 µm to 200 µm.

41. The layered adhesive assembly of claim 31 wherein the adhesive formulation includes 65 to 75% of the adhesive component, 25 to 40% of the tackifier, 0.1 to 5% of the crosslinker, 0.25 to 3% of the antioxidant, and 1.5 to 5% of the microspheres.

42. The layered adhesive assembly of claim 41 wherein the first and second skin layers of adhesive are disposed on the first and second face of the core adhesive layer.

43. The layered adhesive assembly of claim 31, wherein the core adhesive layer comprises a rubber adhesive component.

44. The layered adhesive assembly of claim 31, wherein each of the skin layers comprise a rubber adhesive component.

45. The layered adhesive assembly of claim 31, wherein the core adhesive layer is from 10-175 µm.

46. The layered adhesive assembly of claim 31, wherein each skin layer is from 10-125 µm.

47. The layered adhesive assembly of claim 31, wherein the first and second skin layers are the same composition.