

CLAIMS

1. An entrained polymer composition comprising:

- a. a base polymer material; and
- b. a particulate active agent,

wherein the base polymer material comprises a base polymer, and optionally a flow agent; and wherein at least one of the following is satisfied: 1) the entrained polymer composition has a melt flow index in a range from 200 g/10 min to 5000 g/10 min, optionally from 1000 g/10 min to 4000 g/10 min, optionally from 1200 g/10 min to 2500 g/10 min under ASTM D1238 /ISO 1133 conditions; and 2) the entrained polymer composition has a viscosity in a range from 1,000 cp to 50,000 cp, optionally from 3,000 cp to 40,000 cp, optionally from 3,000 cp to 20,000 cp, optionally from 3,000 cp to 15,000 cp, optionally from 3,000 cp to 10,000 cp, wherein the viscosity is measured with a rheometer at 190 °C after shearing at 5 Hz for two minutes.

2. The entrained polymer composition of claim 1, wherein the entrained polymer composition is a monolithic material and is at least two-phase or at least three-phase.

3. The entrained polymer composition of claim 1 or 2, wherein the flow agent is a polyolefin, a polyolefin derivative, a natural wax, or a synthetic wax.

4. The entrained polymer composition of claim 1 or 2, wherein the flow agent is polyethylene, polyethylene derivatives, ethylene bis(stearamide), or cetyl palmitate.

5. The entrained polymer composition of claim 1 or 2, further comprising a channeling agent.

6. The entrained polymer composition of claim 1 or 2, wherein the base polymer is in a range from 10% to 50%, optionally from 15% to 40%, optionally from 20% to 35%, optionally from 25% to 30% by weight with respect to the total weight of the entrained polymer composition.

7. The entrained polymer composition of claim 1 or 2, wherein the flow agent is in a range from 5% to 50%, optionally from 10% to 35%, optionally from 20% to 30% by weight with respect to the total weight of the entrained polymer composition.

8. The entrained polymer composition of claim 1 or 2, wherein the particulate active agent is in a range from 10% to 80%, optionally from 30% to 60%, optionally from 40% to 50% by weight with respect to the total weight of the entrained polymer composition.

9. The entrained polymer composition of claim 5, wherein the channeling agent is in a range from 1% to 10%, optionally from 1% to 8%, optionally from 1% to 6%, optionally

from 2% to 8%, optionally from 2% to 6%, optionally from 2% to 5%, optionally from 2% to 4% by weight with respect to the total weight of the entrained polymer composition.

10. A method for forming and adhering an entrained polymer structure to a substrate, comprising the steps of:

- a. providing an entrained polymer composition in molten form;
- b. providing a substrate configured to receive application of the entrained polymer composition in molten form; and
- c. applying the entrained polymer composition in molten form in a predetermined shape, to a surface of the substrate, to form thereon the entrained polymer structure upon cooling and solidification,

wherein the entrained polymer composition in molten form comprises a base polymer, a particulate active agent, and optionally a flow agent;

wherein at least one of the following is satisfied: 1) the entrained polymer composition has a melt flow index in a range from 200 g/10 min to 5000 g/10 min, optionally from 1000 g/10 min to 4000 g/10 min, optionally from 1200 g/10 min to 2500 g/10 min under ASTM D1238 /ISO 1133 conditions; and 2) the entrained polymer composition has a viscosity in a range from 1,000 cp to 50,000 cp, optionally from 3,000 cp to 40,000 cp, optionally from 3,000 cp to 20,000 cp, optionally from 3,000 cp to 15,000 cp, optionally from 3,000 cp to 12,000 cp, wherein the viscosity is measured with a rheometer at 190 °C after shearing at 5 Hz for two minutes; and wherein the surface of the substrate is compatible with the entrained polymer composition in molten form so that the entrained polymer composition in molten form thermally bonds therewith, adheres thereto, and solidifies upon sufficient cooling to form thereon the entrained polymer structure.

11. The method of claim 10, wherein the entrained polymer composition further comprises a channeling agent.

12. The method of claim 10 or 11, wherein the entrained polymer composition is a monolithic material and is at least two-phase or at least three-phase.

13. The method of claim 10 or 11, wherein the substrate is a foil and the surface of the substrate is a polymer sealing layer on the foil.

14. The method of any of claims 10-13, wherein the method is carried out using a hot melt dispensing apparatus comprising:

- i. a feeder for providing a flow of the entrained polymer composition in molten form, wherein the feeder is optionally an extruder;

- ii. one or more hoses, each of which having an internal lumen in fluid communication with an exit of the feeder to receive the flow of the entrained polymer composition in molten form; and
- iii. an applicator comprising a dispenser,

wherein the lumen terminates at the applicator to which the entrained polymer composition in molten form is conveyed, and wherein the dispenser applies the entrained polymer composition in molten form in a predetermined shape to the surface of the substrate.

15. The method of claim 14, wherein the entrained polymer composition in molten form is conveyed through the lumen prior to step (c) and the lumen is heated to maintain a molten state of the entrained polymer composition when conveyed through the lumen.

16. The method of any of claims 10-15, wherein the dispenser is heated to maintain a molten state of the entrained polymer composition in step (a) and to facilitate precise formation of the entrained polymer composition in molten state into the predetermined shape in step (c).

17. The method of any of claims 10-16, the dispenser comprising a valve that alternates between a closed state and an open state so as to precisely form the entrained polymer structure in the predetermined shape.

18. The method of any of claims 10-17, wherein the particulate active agent is a granular material that is more abrasive than the base polymer.

19. The method of any of claims 10-18, wherein the active agent is a desiccant, optionally a molecular sieve, a silica gel, a clay, or another desiccant that is a granular material that is more abrasive than the base polymer.

20. The method of any of claims 10-19, wherein one or both of the substrate and entrained polymer structure are flexible materials.

21. The method of any of claims 10-20, wherein prior to step (c), the entrained polymer composition in a pellet form is provided into the feeder and melted to form the entrained polymer composition in molten form.

22. The method of any of claims 10-21, wherein the entrained polymer structure is in the form of: a sheet, a film, a bead, a dot, a strip or a swirl.

23. The method of any of claims 10-22, wherein the entrained polymer structure is in the form of a film having a thickness of from 0.1 mm to 1.5 mm, optionally from 0.2 mm to 1.2 mm, optionally from 0.3 mm to 0.8 mm.

24. The method of any of claims 10-23, wherein the substrate is a foil, the surface of the substrate is a polymer sealing layer on the foil, and the substrate is a portion of a package for

a moisture-sensitive product, optionally wherein the package is a flexible package, a pouch or a blister pack.

25. The method of any of claims 10-24, wherein the method is carried out as part of an automated, in-line package production process.

26. The method of any claims 10-25, wherein the entrained polymer structure adheres to the substrate without use of a separate adhesive material.

27. The method of any previous claims 10-26, wherein the active agent is from 30% to 80%, optionally from 30% to 75%, optionally from 30% to 70%, optionally from 35% to 70%, optionally from 40% to 65%, optionally from 45% to 55%, by weight of the composition.

28. A composite comprising:

a. an entrained polymer structure comprising an entrained polymer, the entrained polymer comprising:

i. a base polymer material; and

ii. a particulate active agent,

wherein the base polymer material comprises a base polymer, and optionally a flow agent,

and wherein at least one of the following is satisfied: 1) the entrained polymer has a melt flow index in a range from 200 g/10 min to 5000 g/10 min, optionally from 1000 g/10 min to 4000 g/10 min, optionally from 1200 g/10 min to 2500 g/10 min under ASTM D1238 /ISO 1133 conditions; and 2) the entrained polymer has a viscosity in a range from 1,000 cp to 50,000 cp, optionally from 3,000 cp to 40,000 cp, optionally from 3,000 cp to 20,000 cp, optionally from 3,000 cp to 10,000 cp, wherein the viscosity is measured with a rheometer at 190 °C after shearing at 5 Hz for two minutes; and

b. a substrate, upon which the entrained polymer structure is adhered.

29. The composite of claim 28, wherein the base polymer material further comprises a channeling agent.

30. The composite of claim 28 or 29, wherein the composite is a portion of a flexible package, pouch or blister pack.