[0004] Shrink film has also been used for encapsulating cylindrical articles such as batteries. Polyvinyl chloride (PVC) films provide acceptable shrinkages of about 40%. However, PVC shrink films have a problem with heat stability. After forming the shrink film, the film should not shrink prematurely. Often, after formation, the film may be exposed to elevated temperatures, such as in transport. Another problem with PVC shrink films is recent concerns over the environmental impact of PVC film. Concern regarding potentially the adverse effect of halogens on the ozone layer has lead to efforts to provide halogen free shrink films.

[0005] Batteries are typically encapsulated by shrink films. The film must shrink sufficiently to encase the battery. A problem with encapsulating batteries and any other cylindrical article is end puckering. End puckering occurs when the shrink film does not shrink sufficiently to provide a smooth encapsulating film at the ends of the battery or the article being encapsulate, and the film folds over itself and forms a "pucker." This puckering is unacceptable to consumers and therefore the manufacturer.

[0006] Battery encapsulating is done at very high speeds. The speed of the labeling is often more that 700 labels applied per minute. It is difficult for typical shrink film labels to work under such high speed conditions.

SUMMARY OF THE INVENTION

[0007] The present ~~invention~~ disclosure provides multilayered a heat shrink film comprising a core layer having an upper and lower surface and comprising a blend of (A) less than 40% of an alpha-olefin copolymer that is a copolymer of ethylene or propylene with an alpha-olefin and (B) a polyolefin copolymer, and (C) an olefin homopolymer; a skin layer on the upper surface of the core layer; and a skin layer on the lower surface of the core layer. The film exhibits excellent shrinkage and is suitable as a shrink film to encapsulate a wide variety of articles including, for example, batteries.

[0008] In one aspect, the present ~~invention~~ disclosure provides a heat shrink label film comprising: a core layer having an upper surface and a lower surface, the core comprising a blend of (A) about 35% or less of an alpha-olefin copolymer comprising a copolymer of a ethylene or propylene and an alpha-olefin; (B) about 60% or more of a polyolefin; and (C) the balance being an olefin homopolymer; a first skin layer disposed about the upper surface of the core layer; and a second skin layer disposed about the lower surface of the core layer, wherein at least one of the first and second skin layers comprises a glycol modified polyester. Also disclosed is a heat shrink label comprising a core layer having an upper surface and a lower surface, the core comprising a blend of (A) about 35% or less of an alpha-olefin copolymer comprising a copolymer of a ethylene or propylene and an alpha-olefin; (B) about 60% or more of a polyolefin; and (C) the balance being an olefin homopolymer; a first skin layer disposed about the upper surface of the core layer; and a second skin layer disposed about the lower surface of the core layer.

[0009] The film may have a shrinkage of at least about 30%. The films have good shrinkage and avoid end puckering. Additionally, the films are printable, even with gravure printing.

[0009a] In another aspect, the present ~~invention~~ disclosure provides an article encapsulated with the multilayer heat shrink film as disclosed herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a cross-sectional view of a label in accordance with an embodiment of the present invention; and

[0011] FIG. 2 is a cross-sectional view of a label in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0012] The present invention provides multilayer shrink films and labels produced therefrom. The films and labels may exhibit a shrinkage of greater than 30% and are suitable to encapsulate a wide range of articles including, but not limited to batteries.

[0013] In accordance with aspects of the present invention, a multilayer shrink film comprises a core layer and skin layers disposed on opposing surfaces of the core layer. The shrink film may comprise additional layers as may be desired including tie layers, adhesive layers, etc. As shown in FIG. 1, a shrink film 100 in accordance with one embodiment of the present invention may comprise a core layer 110

CLAIMS

Having thus described the invention, we claim:

1. A heat shrink film comprising:

a core layer having an upper surface and a lower surface, the core comprising a blend of (A) 35% or less of an alpha-olefin copolymer comprising a copolymer of a ethylene or propylene and an alpha-olefin; (B) 60% or more of a polyolefin; and (C) the balance being an olefin homopolymer;

a first skin layer disposed the upper surface of the core layer; and

a second skin layer disposed the lower surface of the core layer,

wherein at least one of the first and second skin layers comprises a glycol modified polyester.

2. The heat shrink film of claim 1, where the core comprises from 5 to 35% of the alpha-olefin copolymer, or wherein the core comprises from 15 to 30% of the alpha-olefin copolymer, or wherein the core comprises 20% of the alpha-olefin copolymer.

3. The heat shrink film of any of claims 1-2, wherein the alpha-olefin copolymer is a copolymer of (i) ethylene or propylene, and (ii) a C_3-C_{12} alpha-olefin, or wherein the alpha-olefin copolymer is a copolymer of (i) ethylene or propylene, and (ii) 1-butene or 1-hexene.

4. The heat shrink film of any of claims 1-3, wherein the polyolefin copolymer comprises a copolymer of ethylene and propylene.

5. The heat shrink film of claim 4, wherein the polyolefin copolymer has an ethylenic content of 10% or less, or wherein the polyolefin copolymer has an ethylenic content of 3 to 10% by weight.

6. The heat shrink film of any of claims 1-5, wherein the core comprises from 60 to 90% by weight of the polyolefin copolymer, or wherein the core layer comprises from 60 to 80% by weight of the polyolefin copolymer.

7. The heat shrink film of any of claims 1-6, wherein the olefin homopolymer is an ethylene homopolymer or a propylene homopolymer; and/or wherein the core comprises from 1 to 30% by weight of the olefin homopolymer.

8. The heat shrink film of any of claims 1-7, wherein the core layers individually comprise a polyolefin, a polyester, a glycol modified polyester, or a combination of two or more thereof.

9. The heat shrink film of any of claims 1-8, wherein at least one of the skin layers is an adhesive layer; and/or wherein at least one of the skin layers is printable; and/or wherein the ratio of the core layer to the skin layers combined is from 70:30 to 90:10; and/or wherein the ratio of the first skin layer to the core to the second skin layer is 5-20:90-60:20-5.

10. The heat shrink film of any of claims 1-9 further comprising a tie layer disposed between the core layer and at least one of the skin layers.

11. An article encapsulated with the multilayer heat shrink film of any of claims 1-10.

12. The article of claim 11, wherein the article is a battery.

13. The heat shrink film of any of claims 1-10, wherein the glycol modified polyester is polyethylene terephthalate.

CLAIMS

Having thus described the invention, we claim:

1. A heat shrink label comprising:

a core layer having an upper surface and a lower surface, the core comprising a blend of (A) about 35% or less of an alpha-olefin copolymer comprising a copolymer of a ethylene or propylene and an alpha-olefin; (B) about 60% or more of a polyolefin; and (C) the balance being an olefin homopolymer;

a first skin layer disposed about the upper surface of the core layer; and

a second skin layer disposed about the lower surface of the core layer.

2. The heat shrink film of claim 1, where the core comprises from about 5 to about 35% of the alpha-olefin copolymer.

3. The heat shrink film of claim 1, wherein the core comprises from about 15 to about 30% of the alpha-olefin copolymer.

4. The heat shrink film of claim 1, wherein the core comprises about 20% of the alpha-olefin copolymer.

5. The heat shrink film of any of claims 1-4, wherein the alpha-olefin copolymer is a copolymer of (i) ethylene or propylene, and (ii) a C_3-C_{12} alpha-olefin.

6. The heat shrink film of any of claims 1-4, wherein the alpha-olefin copolymer is a copolymer of (i) ethylene or propylene, and (ii) 1-butene or 1-hexene.

7. The heat shrink film of any of claims 1-6, wherein the polyolefin copolymer comprises a copolymer of ethylene and propylene.

8. The heat shrink film of claim 7, wherein the polyolefin copolymer has an ethylenic content of about 10% or less.

9. The heat shrink of claim 7, wherein the polyolefin copolymer has an ethylenic content of about 3 to about 10% by weight.

10. The heat shrink of any of claims 1-9, wherein the core comprises from about 60 to about 90% by weight of the polyolefin copolymer.

11. The heat shrink film of any of claims 1-9, wherein the core layer comprises from about 60 to about 80% by weight of the polyolefin copolymer.

12. The heat shrink film of any of claims 1-11, wherein the olefin homopolymer is an ethylene homopolymer or a propylene homopolymer.

13. The heat shrink film of any of claims 1-12, wherein the core comprises from about 1 to about 30% by weight of the olefin homopolymer.

14. The heat shrink film of any of claims 1-13, wherein the core layers individually comprise a polyolefin, a polyester, a glycol modified polyester, or a combination of two or more thereof.

15. The shrink film of any of claims 1-14, wherein at least one of the skin layers is an adhesive layer.

16. The shrink film of any of claims 1-15, wherein at least one of the skin layers is printable.

17. The shrink film of any of claims 1-16, wherein ratio of the core layer to the skin layers combined is from about 70:30 to about 90:10.

18. The shrink film of any of claims 1-17, wherein the ratio of the first skin layer to the core to the second skin layer is about 5-20:90-60:20-5.

19. The shrink film of any of claims 1-18 further comprising a tie layer disposed between the core layer and at least one of the skin layers.

20. An article encapsulated with the multilayer shrink film of any of claims 1-19.

21. The article of claim 20, wherein the article is a battery.