coating or other techniques. Skin layers can serve a variety of purposes, such as protection of the interior layers, for example, against scratching or abrasion, stiffening or strengthening or providing dimensional stability to the entire film, hosting additives such as ultraviolet light stabilizers, reducing surface reflection, providing an appropriately receptive surface for subsequent coatings, or others.

The term "premask" is often used to refer to a surface layer, either produced with the rest of the film or added later by such means as lamination, extrusion coating, solvent coating, or other means, intended to protect the film temporarily against damage during handling, processing, converting and the like, and is further intended to be removed before final use of the film or of portions cut from the film. A so-called "strippable skin" can serve as a premask. It will be understood that a film can also be prepared with a skin layer, say, by coextrusion, and have a premask applied thereon, say, by lamination, whereupon the skin layer is no longer, temporarily, the film construction's external-most layer, but is intended at a later time once again to serve as the external layer, after removal of the premask.

A challenge with polymer films is that when contacted to other films, e.g., such as when wound into roll form or arranged into a stack of sheets, the films may tend to adhere strongly if they are too close to having perfectly smooth surfaces. This is sometimes referred to as "blocking", making a roll difficult to unwind or a sheet difficult to remove from the stack. Alternatively, if a film surface is made too slippery, film on a roll may tend to slip upon itself, sideways, resulting in what is often referred to as roll "telescoping". Good roll formation with acceptable unwindability requires that the film surface strike a balance.

US Patent Nos. 5,328,755 and 5,332,617 (both Mills et al.) disclose formation of particle-filled layers on polymeric films to increase the surface roughness thereof to improve the handling properties thereof.

In some cases, portions of a sheet are roughened, e.g., by imparting knurled portions on the edges thereof, to make the sheets easier to handle and to impart a tendency to "stand off" from articles into which they are contacted, e.g., other sheets in a stack or other portions of the same sheet when wound into roll form. The use of such measures frequently degrade the subject portions of the sheet, thereby reducing yields and incurring additional costs.

The need exists for improved ways to improve the handling properties of polymer films and sheets. In particular, there is a need for a way of improving the handling properties of polymer films that allows a particle-filled layer to be coated onto a film at some point in the film-making process while minimizing the amount of binder polymer needed in the coating.

Summary

The present ~~invention~~ disclosure provides a novel polymeric sheet construction that exhibits surprisingly facile performance and handling properties and a novel method for making such novel polymeric sheet constructions.

In brief summary, a sheet of the disclosure ~~invention~~ comprises: (1) a core member comprising one or more layers and having a first major surface and (2) a slip control layer as described herein. The slip control layer is disposed on at least a portion of the first major surface and comprises: (i) a footing layer disposed on the first major surface of the core member, (iii) a binder layer disposed on the footing layer, and (iii) an array of particles disposed in the binder layer and footing layer and protruding therefrom. Hence, in a first aspect, there is provided a sheet comprising: (1) a core member comprising one or more layers and having a first major surface and (2) a slip control layer disposed on at least a portion of the first major surface, wherein the slip control layer comprises: (i) a footing layer disposed on at least a portion of the first major surface of the core member, (ii) a binder layer disposed on the footing layer, and (iii) an array of particles disposed in the binder layer and footing layer and protruding therefrom, wherein the average diameter of the particles is greater than the combined thickness of the footing layer and binder layer such that the particles protrude from the slip control layer opposite the core member. In sheets of the ~~invention~~disclosure, the average diameter of the particles is greater than the combined thickness of the foot layer and binder layer.

In a second aspect, there is provided the sheet as defined herein arranged in substantially planar form. In a third aspect, there is provided a plurality of sheets as defined herein arranged in a stack. In a fourth aspect, there is provided the sheet as defined herein wound upon itself into roll form.

Briefly summarizing, the method of the disclosure ~~invention~~ for making such sheets comprises: (1) providing a core member comprising one or more layers and having a first major surface; (2) forming a footing layer on at least a portion of the first major surface; (3) applying a binder layer composition containing particles as described herein on at least a portion of the footing layer; then (5) tentering the assembly under sufficient heat to soften the footing layer such that particles sink into the footing layer perhaps so far so as to contact the first major surface of the core member, wherein the average diameter of the particles is greater than the combined thickness of the footing layer and the binder layer. Hence, in a fifth aspect, there is provided a process for making a sheet comprising: (1) providing a core member comprising one or more layers and having a first major surface; (2) forming a footing layer on at least a portion of the first major surface, wherein the footing layer is viscoelastic and has a T_g that is lower than either the T_g or the T_m of the polymer at the first major surface of the core member; (3) applying a binder layer composition comprising a film forming polymer and particles to the surface of the footing layer; then (4) tentering the assembly under sufficient heat to soften the footing layer such that the particles sink into the footing layer, the footing layer, binder layer, and particles constituting a slip control layer, wherein the average diameter of the particles is greater than the combined thickness of the footing layer and binder layer such that the particles protrude from the surface of the slip control layer opposite the core member.

Sheets of the invention can be easily handled, e.g.., during manufacture and subsequent converting. Exploitation of the invention can make possible surprising improvements in runability, reduced waste, and improved yields.

Brief Description of Drawing

The invention is further explained with reference to the drawing wherein:

Fig. 1 is a cross-sectional view of a portion of a sheet of the invention;

Fig. 2 is an end view of a plurality of sheets of the invention arranged in a stack; and

Fig. 3 is an end view of a portion of a sheet of the invention wound into roll form;

These figures are idealized, are not to scale and are intended to be merely illustrative and not limiting.

Key and Glossary

For the following defined terms, these definitions shall be applied, unless a different definition is given in the claims or elsewhere in this specification.

The term "polymer" will be understood to include polymers, copolymers (e.g., polymers formed using two or more different monomers), oligomers and combinations thereof, as well as polymers, oligomers, or copolymers that can be formed in a miscible blend by, for example, coextrusion or reaction, including transesterification. Both block and random copolymers are included, unless indicated otherwise.

Unless otherwise indicated, all numbers expressing quantities of ingredients, properties such as molecular weight, reaction conditions, and so forth used in the specification and claims are to be understood as being modified in all instances by the term "about". Accordingly, unless indicated to the contrary, the numerical parameters set forth in the foregoing specification and attached claims are

What is claimed is:

1. A sheet comprising:

(1) a core member comprising one or more layers and having a first major surface and

(2) a slip control layer disposed on at least a portion of the first major surface, wherein the slip control layer comprises: (i) a footing layer disposed on at least a portion of the first major surface of the core member, (ii) a binder layer disposed on the footing layer, and (iii) an array of particles disposed in the binder layer and footing layer and protruding therefrom, wherein the average diameter of the particles is greater than the combined thickness of the footing layer and binder layer such that the particles protrude from the slip control layer opposite the core member.

2. The sheet of claim 1 wherein the core member comprises multilayer optical film.

3. The sheet of claim 1 wherein the footing layer is amorphous.

4. The sheet of claim 1 wherein the footing layer is viscoelastic and has a T_g that is lower than either the T_g or the T_m of the polymer at the first major surface of the core member.

5. The sheet of claim 1 wherein the footing layer has a T_g of at least about 85°C.

6. The sheet of claim 1 wherein the footing layer is strippable from the core member.

7. The sheet of claim 1 wherein the footing layer is from about 0.5 to about 3 microns thick.

8. The sheet of claim 1 wherein the binder layer is from about 100 to about 500 nanometers thick.

9. The sheet of claim 1 wherein a mean particle diameter of the particles is from about 2 to about 30 microns.

10. The sheet of claim 1 wherein the particles constitute from about 5 to about 20 weight percent of the total weight of the particles plus binder layer.

11. The sheet of claim 1 wherein the core member has a second major surface further comprising a second footing layer disposed on the second major surface, a second binder layer disposed on the second footing layer, and an array particles disposed in the second binder layer and second footing layer and protruding therefrom on the side opposite the core member.

12. The sheet of claim 1 arranged in substantially planar form.

13. A plurality of sheets of claim 12 arranged in a stack.

14. The sheet of claim 1 wound upon itself into roll form.

15. A process for making a sheet comprising:

(1) providing a core member comprising one or more layers and having a first major surface;

(2) forming a footing layer on at least a portion of the first major surface, wherein the footing layer is viscoelastic and has a T_g that is lower than either the T_g or the T_m of the polymer at the first major surface of the core member;

(3) applying a binder layer composition comprising a film forming polymer and particles to the surface of the footing layer; then

(4) tentering the assembly under sufficient heat to soften the footing layer such that the particles sink into the footing layer, the footing layer, binder layer, and particles constituting a slip control layer, wherein the average diameter of the particles is greater than the combined thickness of the footing layer and binder layer such that the particles protrude from the surface of the slip control layer opposite the core member.

16. The process of claim 15 wherein the core member comprises multilayer optical film.

17. The process of claim 15 wherein the footing layer and core member are formed simultaneously via coextrusion.

18. The process of claim 15 wherein the footing layer is amorphous.

19. The process of claim 15 wherein the footing layer has a T_g of at least about 85°C.

20. The process of claim 15 wherein the footing layer is from about 0.5 to about 3 microns thick.

21. The process of claim 15 wherein the binder layer composition comprises a film forming component, particles, and water.

22. The process of claim 15 wherein the binder layer composition is applied to the surface of the footing layer and self-levels.

23. The process of claim 15 wherein the binder layer composition is at least partially dried before tentering.