METHOD AND APPARATUS FOR FORMING ARTICLES WITH NON-UNIFORM DISCONTINUOUS PATTERNED COATINGS

TECHNICAL FIELD

[0001] The present disclosure relates generally to the application of coatings to substrates, and more particularly to the application of non-uniform coatings.

BACKGROUND

[0002] The fabrication of numerous commercial products includes the step of applying a coating to a substrate in the form of a sheet or a web of indefinite length. For some applications it is desirable to have an overall uniform coating on the substrate, while in others it is desirable to apply a non-uniform coating in the form of, e.g., a multiplicity of stripes. The non-uniform coating may be applied directly to the substrate or to an intermediate surface with subsequent transfer to the substrate, or may be applied superimposed over an earlier uniform coating on the substrate. For example, the use of needle tubes to apply stripes of a coating material to a coating roll has been described, for example in Maier, PCT Patent Publication WO2011/087657.

SUMMARY

[0003] The present disclosure describes a method of applying a coating material onto a substrate, including providing a first distribution manifold having a cavity and a multiplicity of first dispensing outlets in fluid communication with the cavity, creating relative motion between a substrate and the dispensing outlets in a first direction; dispensing a first coating material from the dispensing outlets while maintaining the relative motion and translating the multiplicity of dispensing outlets in a second direction non-parallel to the first direction, and varying a rate of dispensing of the first coating material in a predetermined fashion to form a discontinuous pattern of the first coating material on a major surface of the substrate.

[0003a] In one aspect, the present disclosure relates to a method of applying a coating material to a substrate, comprising: providing a first distribution manifold having a cavity and a plurality of first dispensing outlets in fluid communication with the cavity; creating relative motion between a substrate and the dispensing outlets in a first direction; dispensing a first coating material from the dispensing outlets while maintaining the relative motion and translating the plurality of dispensing outlets in a second direction non-parallel to the first direction; and varying a rate of dispensing of the first coating material in a predetermined fashion to form a discontinuous pattern of the first coating material on a major surface of the substrate; and

providing a second plurality of dispensing outlets in fluid communication with a cavity and dispensing a second coating material from the second dispensing outlets while maintaining the relative motion and simultaneously translating the plurality of second dispensing outlets in a second direction non-parallel to the first direction to form a discontinuous pattern of the second coating material on the major surface of the substrate, further wherein the second plurality of dispensing outlets is interleaved with the first plurality of dispensing outlets, additionally wherein the varying of the rate of dispensing the second coating material in a predetermined fashion from at least one of the first dispensing outlets and the second dispensing outlets includes at least one time period wherein the rate of dispensing the second coating material in a predetermined fashion is zero, causing the pattern formed by dispensing the coating material from at least one of the first dispensing outlets and the second dispensing outlets to cross the pattern formed by dispensed the coating material from the other dispensing outlets so that the patterns cross over each other without overlapping the coating material.

[0004] In some exemplary embodiments of the foregoing method, wherein the varying the rate of dispensing of the first coating material in a predetermined fashion includes at least one time period wherein the rate of dispensing is zero. In these or other embodiments, the varying the rate of dispensing of the first coating material in a predetermined fashion includes at least one time period wherein the rate of dispensing is periodic. In some embodiments, the rate of dispensing of the first coating material in a predetermined fashion includes at least one time period wherein the rate of dispensing is random or quasi-random.

Claims

1. A method of applying a coating material to a substrate, comprising:

providing a first distribution manifold having a cavity and a plurality of first dispensing outlets in fluid communication with the cavity;

creating relative motion between a substrate and the dispensing outlets in a first direction; dispensing a first coating material from the dispensing outlets while maintaining the relative motion and translating the plurality of dispensing outlets in a second direction non-parallel to the first direction; and

varying a rate of dispensing of the first coating material in a predetermined fashion to form a discontinuous pattern of the first coating material on a major surface of the substrate; and

providing a second plurality of dispensing outlets in fluid communication with a cavity and dispensing a second coating material from the second dispensing outlets while maintaining the relative motion and simultaneously translating the plurality of second dispensing outlets in a second direction non-parallel to the first direction to form a discontinuous pattern of the second coating material on the major surface of the substrate, further wherein the second plurality of dispensing outlets is interleaved with the first plurality of dispensing outlets, additionally wherein the varying of the rate of dispensing the second coating material in a predetermined fashion from at least one of the first dispensing outlets and the second dispensing outlets includes at least one time period wherein the rate of dispensing the second coating material in a predetermined fashion is zero, causing the pattern formed by dispensing the coating material from at least one of the first dispensing outlets and the second dispensing outlets to cross the pattern formed by dispensed the coating material from the other dispensing outlets so that the patterns cross over each other without overlapping the coating material.

2. The method according to claim 1 wherein the varying the rate of dispensing of the first coating material in a predetermined fashion includes at least one time period wherein the rate of dispensing is zero.

3. The method according to claim 1 or 2 wherein the varying the rate of dispensing of the first coating material in a predetermined fashion includes at least one time period wherein the rate of dispensing is periodic.

4. The method according to any one of the preceding claims wherein the rate of dispensing of the first coating material in a predetermined fashion includes at least one time period wherein the rate of dispensing is random or quasi-random.

5. The method according to any one of the preceding claims wherein the varying the rate of dispensing of the second coating material in a predetermined fashion includes at least one time period wherein the rate of dispensing is periodic.

6. The method according to any one of the preceding claims wherein the rate of dispensing of the second coating material in a predetermined fashion includes at least one time period wherein the rate of dispensing is random or quasi-random.

7. The method according to any one of the preceding claims wherein the first and the second directions are orthogonal to each other.

8. The method according to any one of the preceding claims wherein the distribution manifold may be separated into a manifold chamber containing the cavity, and a removable cartridge having the plurality of needle tubes.

9. The method according to any one of the preceding claims wherein at least one of the first plurality of dispensing outlets or the second plurality of dispensing outlets comprises a plurality of hollow needle tubes.

10. The method according to claim 9 wherein the hollow tubular needles are flexible.

11. The method according to claim 10 wherein the flexible hollow needle tubes comprise metal, thermoplastic polymer, fused silica, or a combination thereof.

12. The method according to any one of the preceding claims wherein the discontinuous patterns formed by the dispensed first and second coating materials on the substrate are a single layer pattern.

13. The method according to any one of claims 1 to 11 wherein the discontinuous patterns formed by the dispensed first and second coating materials on the substrate are a dual layer pattern.

14. The method according to any one of the preceding claims wherein the first and second coating materials are different materials.

15. The method according to any one of claims 1-13 wherein the first and second coating materials are the same material.

16. A coated article prepared according to the method of any one of the preceding claims wherein the coated article is selected from an air barrier membrane, an adhesive tape, a paint masking film, or a drug delivery patch.