DUAL-SIDED STRUCTURED FILM ARTICLES

Field of the Disclosure

This disclosure relates generally to film articles with dual-sided structures, and methods for preparing them.

Background

A wide range of articles, such as films, sheets and the like have two major surfaces. It is often desirable in the fabrication of such articles to be able to produce a structured surface on both of the major surfaces. Various techniques have been developed for producing a structured surface on both major surfaces of an article.

In US Patent No. 7,165,959 (Humlicek et al.) an apparatus is described for casting a patterned surface on both sides of a web. The apparatus includes two patterned rolls maintained in continuous registration to within at least 100 microns. Similarly, US Patent No. 7,484,950 (Mizunuma et al.) describes an alignment device for forming double-surface formed sheets. In this device a first forming roll and a second forming roll are provided parallel and opposite to each other, and control devices are provided that reduce the phase difference between the forming shapes on the two surfaces.

US Patent Publication 2012/0156777 (Rangarajan et al.) describes a carrier for growing adherent cells which comprises one or more outer surfaces and one or more structured indentations on one or more of the outer surfaces.

Summary

Described herein are film articles that are structured substrates with dual-sided structures, and methods for preparing them. Structured substrates with dual-sided structures are ones in which both of the major surfaces of the substrate have a structured surface, generally a microstructured surface.

In some embodiments, the structured substrate comprises a first major surface and second major surface, where the first major surface and the second major surface each comprise a plurality of spaced apart protrusions forming a repeating microstructured pattern. The patterns on first and second major surface are offset at an angle to each other. Each repeating microstructured pattern has a major axis, where the major axis comprises one of the major axes in the translational direction of the repeating microstructured pattern. The major axis of the repeating microstructured

What is claimed is:

1. A structured substrate comprising:
a first major surface and second major surface, wherein the first major surface and the second major surface each comprise a plurality of spaced apart protrusions forming a repeating microstructured pattern, wherein the patterns on first and second major surface are offset at an angle to each other, each repeating microstructured pattern having a major axis, wherein the major axis comprises one of the major axes in the translational direction of the repeating mircrostructured pattern, and wherein the major axis of the repeating microstructured pattern on the second major surface forms an oblique angle with the major axis on the first major surface, wherein the angle is in the range of 10-90% of the angle of rotational symmetry of the repeating microstructured pattern, and wherein the structured substrate is a unitary substrate.

2. The structured substrate of claim 1, wherein the repeating microstructured pattern on the first major surface and/or the second major surface comprise any periodic geometric pattern.

3. The structured substrate of claim 2, wherein the periodic geometric pattern comprises a pattern of squares, a pattern of hexagons, a pattern of triangles, or a pattern of circles.

4. The structured substrate of claim 1, wherein the repeating microstructured pattern on the first major surface is the same as the repeating microstructured pattern on the second major surface.

5. The structured substrate of claim 1, wherein the angle is in the range of 20-80% of the angle of rotational symmetry of the repeating microstructured pattern.

6. The structured substrate of claim 1, wherein the repeating microstructured pattern on the first major surface and the repeating microstructured pattern on the second major surface form an array of cavities, and wherein the protrusions form the walls of the cavities.

7. The structured substrate of claim 6, wherein the array of cavities comprises an array of square cavities.