ASYMMETRIC TURNING FILM WITH MULTIPLE LIGHT SOURCES

Background

Turning films are used in many display and lighting applications to change the angular distribution of light. Turning films generally have features which operate by refracting and/or reflecting light. Turning films may be used in conjunction with light sources to provide a desired light output.

Summary

In one aspect, the present disclosure relates to an optical system. The optical system includes a first light source and a second light source having differently orientated light distributions, an asymmetric turning film including a first major surface and a second major surface, where the first major surface is substantially smooth in that it does not contain microstructures and the second major surface includes a plurality of microstructures each having a first face having a first shape and a second face having a different second shape, and a polarizer, where light from the first light source is preferentially reflected by the first face but not the second face, and is transmitted through the second face, and where light from the second light source is preferentially reflected by the second face but not the first face, and is transmitted through the first face, and where the asymmetric turning film is laminated to the polarizer. In some embodiments, the optical system further includes a lightguide configured to transport light from at least one of the first light source and the second light source. The optical system may include a second turning film disposed on the opposite side of the lightguide from the first asymmetric turning film. In some embodiments, the second turning film may be an asymmetric turning film. In some embodiments, the asymmetric turning film has a plurality of microstructures each having a third face having a third shape and a fourth face having a different fourth shape, where light from the first light source is preferentially reflected by the third face but not the fourth face and light from the second light source is preferentially reflected by the fourth face but not the third face.

In another aspect , the present disclosure relates to an optical system, comprising a first light source and a second light source having differently oriented light distributions;

a first lightguide configured to transport light from at least one of the first light source and the second light source;

a second lightguide configured to transport light from at least one of the first light source and the second light source; and

an asymmetric turning film comprising a first major surface and a second major surface, wherein the first major surface is substantially smooth in that it does not contain microstructures and the second major surface comprises a plurality of microstructures each comprising a first face having a first shape and a second face having a different second shape;

wherein light from the first light source is preferentially reflected by the first face but not the second face, and is transmitted through the second face;

wherein light from the second light source is preferentially reflected by the second face but not the first face, and is transmitted through the first face; and

wherein the first lightguide and the second lightguide are stacked.

What is claimed is:

1. An optical system, comprising:

a first light source and a second light source having differently oriented light distributions;

an asymmetric turning film comprising a first major surface and a second major surface, wherein the first major surface is substantially smooth in that it does not contain microstructures and the second major surface comprises a plurality of microstructures each comprising a first face having a first shape and a second face having a different second shape; and

a polarizer;

wherein light from the first light source is preferentially reflected by the first face but not the second face, and is transmitted through the second face;

wherein light from the second light source is preferentially reflected by the second face but not the first face, and is transmitted through the first face; and

wherein the asymmetric turning film is laminated to the polarizer.

2. The optical system of claim 1, further comprising a lightguide configured to transport light from at least one of the first light source and the second light source.

3. The optical system of claim 2, further comprising a second lightguide configured to transport light from at least one of the first light source and the second light source.

4. The optical system of claim 3, wherein the first lightguide and the second lightguide are stacked.

5. An optical system, comprising:

a first light source and a second light source having differently oriented light distributions;

a first lightguide configured to transport light from at least one of the first light source and the second light source;

a second lightguide configured to transport light from at least one of the first light source and the second light source; and

an asymmetric turning film comprising a first major surface and a second major surface, wherein the first major surface is substantially smooth in that it does not contain microstructures and the second major surface comprises a plurality of microstructures each comprising a first face having a first shape and a second face having a different second shape;

wherein light from the first light source is preferentially reflected by the first face but not the second face, and is transmitted through the second face;

wherein light from the second light source is preferentially reflected by the second face but not the first face, and is transmitted through the first face; and

wherein the first lightguide and the second lightguide are stacked.

6. The optical system of claim 1 or claim 5, wherein the first shape is flat and the second shape is curved.

7. The optical system of claim 1 or claim 5, wherein each of the plurality of microstructures is the same lateral cross-sectional shape.

8. The optical system of claim 1 or claim 5, wherein each microstructure of the plurality of microstructures further comprises a third face having a third shape, wherein either light from the first light source is preferentially reflected by the first face and the third face but not the second face or light from the second light source is preferentially reflected by the second face and the third face but not the first face.

9. The optical system of claim 1 or claim 5, further comprising a second plurality of microstructures, each comprising a third face having a third shape and a fourth face having a different fourth shape, wherein the third face preferentially reflects light from the first light source but not the second light source, wherein the fourth face preferentially reflects light from the second light source but not the first light source, and wherein at least two of the first shape, the second shape, the third shape, and the fourth shape are different.

10. The optical system of claim 1 or claim 5, wherein the second major surface of the asymmetric turning film includes at least one of an antireflective coating or an antireflective structured surface.

11. The optical system of claim 5, wherein the first major surface of the asymmetric turning film includes at least one of an antireflective coating or an antireflective structured surface.

12. The optical system of claim 1 or claim 5, wherein at least one of the first face or the second face includes a sawtooth or sinusoidal surface.

13. The optical system of claim 1 or claim 5, wherein the optical system has two display modes, wherein in the first mode, only the first light source emits light, and in the second mode, only the second light source emits light.

14. The optical system of claim 13, wherein the optical system has a third mode, wherein in