TEXTURED COATING FOR OPTICAL PRODUCTS

BACKGROUND

Optical displays in devices such as mobile telephones, personal digital assistants (PDAs), liquid crystal display (LCD) panels, televisions, computers, and the like can have screens or lens elements made from a substrate such as, for example, glass or a polymeric film. In some optical displays the substrate has applied thereon a coating to create a matte appearance that scatters light emitted by a backlight underlying the substrate and can hide defects in the display materials. In some optical displays, the matte coating is formed by the use of polymeric beads or inorganic oxide particles, and/or structured surfaces. Particle settling and agglomeration in the coating fluids can make these coatings difficult to manufacture with consistent and reproducible quality.

SUMMARY

It can be difficult to apply a coating composition with bead-like particles to a substrate and form a uniform coating with good and consistent optical quality. The bead-like particles can settle out of the coating composition over time or agglomerate. The beads can deform as they are applied to a substrate during a coating process, or can scratch or otherwise mar the substrate. The uneven distribution of the bead-like particles in the coating composition can cause non-uniform surface tension or stretching during the coating process, which can produce a coating with streaks, lumps, and uneven thickness. These irregularities degrade optical quality, which can create variations in the brightness of a display, cause excessive glare for a display user, or result in undesirable patterns that interfere with the user interface or the user experience.

In one aspect, the present disclosure is directed to a method comprising:

coating a surface of a substrate with a coating composition to form a coating layer thereon, wherein the coating composition comprises:

a first polymer and a second polymer, wherein the first polymer and the second polymer are incompatible and non-reactive with one another, and wherein the absolute value of the difference between the refractive index of the first polymer and the refractive index of the second polymer is about 0 to about 0.01, and

a carrier liquid, wherein the first polymer and the second polymer are soluble in the carrier liquid, and wherein the carrier liquid is a good solvent for the first polymer and a poor solvent for the second polymer; and

removing the carrier liquid from the coating layer to spinodally decompose the mixture of the first polymer and the second polymer, wherein the carrier liquid is removed in an amount

sufficient to form a substantially continuous first phase comprising a predominant amount of the first polymer and a substantially discontinuous second phase comprising a predominant amount the second polymer, wherein at least 70% of the second phase comprises droplets with an aspect ratio, when viewed in the plane of the surface of the substrate, of less than about 3.

In another aspect, the present disclosure is directed to an optical element comprising:

a light transmissive substrate; and

a continuous coating on the substrate, wherein the coating comprises:

a first region comprising a first polymer selected from cellulose resins and (meth)acrylic resins; and

a second region comprising a second polymer different from the first polymer, wherein the second polymer is selected from cellulose resins and (meth)acrylic resins; wherein the first polymer and the second polymer are incompatible and non-reactive with one another, and wherein the absolute value of the difference between the refractive index of the first polymer and the refractive index of the second polymer is about 0 to about 0.01, and wherein the first regions have a thickness different from the second regions.

The coating described in the present disclosure does not include beads, and can reduce scratching of adjacent optical surfaces or structures. The coating of this disclosure can be used on any light transmissive substrate to eliminate or reduce the appearance of at least one of pixel or reflective Moiré, prism or substrate color mura (irregularity or un-evenness), or interference patterns such as Newton's Rings. In various embodiments, the coatings have low graininess and small feature size, and provide a wide and smooth viewing and brightness viewing angle. In various embodiments, the coatings can subdue sparkle or dazzle, hide defects, and are sufficiently tough and resilient to reduce or eliminate imprinting caused by contact with adjacent optical surfaces or structures.

The details of one or more embodiments of the disclosure are set forth in the accompanying drawings and the description below. Other features, objects, and advantages of the disclosure will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a schematic cross-sectional view of a process for forming a coating layer.

FIG. 2 is a schematic cross-sectional view of a coating layer.

FIG. 3 is a plot of the topography of the coating of Example 8.

FIG. 4 is a photograph of the surface of the coating of Example 8.

FIG. 5 is a plot of the topography of the surface of Example 14.

FIG. 6 is a photograph of the surface of the coating of Example 14.