Patterning Silica Islands Onto Thermoplastic Shrink Film

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OTHER INFORMATION

CATEGORIZED AS

- **Materials & Chemicals**
  - Biological
  - Polymers
  - Thin Films
- **Medical**
  - Screening
- **Sensors & Instrumentation**
  - Analytical
  - Biosensors
  - Medical
  - Scientific/Research

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BRIEF DESCRIPTION

Researchers at UCI have developed a quick and inexpensive method for the controllable patterning of silica onto polymer films, for use in biosensing applications.

FULL DESCRIPTION

Silica-based biosensors are extensively used in applications ranging from real-time glucose monitoring to drug discovery and validation. Such sensors are preferred due to their lightweight and robust composition as well as their optical transparency, which allows for phenomena such as analyte absorption or fluorescence to be detected remotely. The most sensitive silica biosensors have a high density of silica in sensing areas, which are typically anchored onto an underlying substrate. Currently, patterning of crystalline silica is an expensive and time-consuming process. Whereas sol-gel based methods such as spin- and dip-coating offer lower cost alternatives, they are highly uncontrollable and often results in random or uneven silica distribution.

To control both silica shape and density, researchers at UCI have developed a novel method for the deposition of silica “islands” onto polymer shrink films. First, a “shadow mask” is applied to the polymer film. The shadow mask contains “holes” that define the regions of desired silica deposition and can be created using common design software. Once applied to the polymer film, the entire structure is plasma treated, which introduces hydroxyl groups to the material surface. After plasma treatment, the shadow mask is etched away, removing the surface hydroxyl groups from these regions. Subsequent sol-gel deposition of silica onto the film leads to silica adhering only to the remaining hydroxyl-coated areas (the “holes” left exposed by the shadow film). Finally, the polymer films are heat shrunk, causing the regions of silica deposition to be concentrated into high-density islands on the surface of the film. This method is highly tunable, as parameters such as the shape of the silica patterns, final film shrinkage, and final silica density can be controlled by the geometry of the shadow mask, extent of plasma treatment, and choice of polymer shrink film, respectively.

SUGGESTED USES

For the selective patterning of liquid silica onto surfaces

ADVANTAGES

· Inexpensive: As silica deposition is achieved via sol-gel techniques, this process is much less expensive than crystalline deposition methods.

· Quick: The fabrication time is limited only by the time required to draw the shadow mask pattern.

· Customizable: Final film parameters including the shape and density of the silica islands, as well as the final film texture, are easily controlled during fabrication.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,169,149	11/09/2021	2015-407

STATE OF DEVELOPMENT

ROI lists technology as being in the experimental stage, although the invention was patented in 2016.

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