



Inventors

Dr. Christiana Honsberg

Professor

*School of Electrical, Computer
and Energy Engineering*

JeaYoung Choi

Graduate Research Associate

*School for Engineering of
Matter, Transport and Energy*

Size-Controllable Silica Nano-/Micro-Sphere Lithography Technique

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Background

Nanostructures within semiconductors increase their performance and have proven to be especially effective for light management, for example, nanostructured solar cells that absorb more energy over a greater range of the solar spectrum. Although less production material is used, the process of creating semiconductors layered with nano-textured surfaces involves expensive and time-consuming lithography techniques that are imprecise over the large surface areas needed for manufacturing. Since its invention, nanosphere lithography has been an economical solution that applies ordered arrays of micro or nanometer-scale silica spheres of various sizes in order to create the desired surface texturing. However, current techniques require a re-optimization of the silica sphere deposition process for each differently-sized sphere. This tedious method can produce unexpected patterning due to a lack of interspacing control between structures, which may cause short-circuit, device performance drift, and other product defects.

Invention Description

Researchers at ASU have developed a nanosphere lithography technique with enhanced control over the size of the silica spheres. Using low cost procedures such as reactive ion etching (RIE) for dry etching or potassium hydroxide (KOH) etching for wet etching, sphere size can be adjusted without re-optimization of the deposition process and can be arranged with identical shape and size or a mix of various shapes and sizes. Additionally, treating the surface with ultraviolet ozone removes the organic residue left behind by both kinds of etching that causes further spatial inconsistencies. This lithography technique was experimentally verified to produce uniformly patterned surfaces with adjustable interspacing between structures, providing manufacturers with an economical process for creating nanostructured surfaces that are ideal for light management.

Intellectual Property

Status:

Pending

Potential Applications

- Optoelectronic Device Manufacturing
- Photovoltaic Design
- Semiconductor Fabrication

Contact

Bill Loux

*Director of Business
Development, Physical
Sciences*

*Arizona Technology
Enterprises, LLC (AzTE)*

P: 480.884.1992

F: 480.884.1984

BLoux@AZTE.COM

TECHNOLOGYVENTURES@AZTE.COM

Benefits and Advantages

- **Economical** – Uses low cost procedures such as RIE and KOH etching to modify sphere size and spacing.
- **Effective** – Can be applied over large surfaces areas needed for manufacturing.
- **Innovative** – Adjustable interspacing between nanostructures facilitates novel semiconductor designs ideal for light management.
- **Reliable** – Ultraviolet ozone treatment provides consistent uniform etching for superior product fabrication.