Superhydrophobic Induced High Numerical Plastic Lenses

Tech ID: 24054 / UC Case 2014-125-0

BRIEF DESCRIPTION

The application of novel manufacturing techniques, chemical modifications and alternative materials produces the next generation of lenses. These lenses are inexpensive, contain improved numerical aperture and can be easily manufactured. Overall, these improvements create new applications for miniaturized optical and optical electronic devices.

FULL DESCRIPTION

The creation of miniaturized optical and optoelectronic devices drive the availability to image small things such as biologics. They possess a wide range of applications, which include biomedical instruments, optical data storage and optical communications. We have developed simple and inexpensive manufacturing techniques to produce smooth symmetrical lenses with high magnification. In addition, there is great interest in the optical lens industry to shift from using glass to polymers, thereby simplifying the manufacturing process.

Currently lenses are constructed by using labor and equipment intensive photolithography, laser ablation, or UV curable materials. Photoresist is used to create the hemispherical shaped lenses because of its surface tension. However, this element generates limitations to the photoresist's geometry and thickness, therefore resulting in limited numerical aperture >0.15. For these reasons, there is a great need for producing an inexpensive master lens with high numerical aperture.

The application of alternative materials and chemical modifications for the production of lenses creates new manufacturing techniques as well as improve lenses' numerical aperture. By using pre-stressed polymers during the manufacturing process it can produce superhydrophobic (SH) features that allow for further manipulation of numerical aperture. These SH features can be made on polymers such as PDMS and hard plastics. These modifications made to the surface affect the water droplet's shape thereby allowing control to create smooth, symmetrical lenses. Ultimately, this can be molded with PDMS and hard plastics to create smooth, symmetrical tunable optical lenses.

University of California, Irvine researchers demonstrate the use of chemical modifications during the simple manufacturing process to create polymer lenses with increased numerical aperture.

SUGGESTED USES

Lenses play an important role in many industries. There are many limitations when producing lenses with glass and traditional manufacturing methods. The addition of chemical modifications during the simple manufacturing process will produce inexpensive lenses with higher numerical aperture than traditional lenses.

As a result of the simple manufacturing technique, these lenses can be used for educational outreach as a kit to teach students about optics. Since the lenses can be made with high magnification, they can be integrated with electronics such as cell phone cameras. In addition, these lenses can be applied to point-of-care diagnostics and viewing very small biological components where costly and bulky microscopes are not accessible.

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OTHER INFORMATION

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Agriculture & Animal Science**
  - Chemicals
  - Devices
  - Processing and Packaging
- **Biotechnology**
  - Health
  - Other
- **Communications**
  - Optical
- **Engineering**
  - Engineering
- **Imaging**

Overall, the development of inexpensive manufacturing techniques to create high numerical aperture polymer lenses paves the way for new applications of miniaturized optics and optoelectronic devices.

ADVANTAGES

There are many advantages to creating polymer lenses with the use of chemical modifications. They include:

- Simple manufacturing process

- Using polymers and plastic are inexpensive

- Easily modified to create high numerical aperture for high magnification

- Able to achieve lenses with variable magnification

- Process can be scaled up for large manufacturing

- Does not require expensive equipment

- Can be made in a classroom setting, therefore making it a an educational outreach tool

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,005,248	06/26/2018	2014-125

RELATED CASES

2014-125-0

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