Low-Cost And Portable Uv Holographic Microscope For High-Contrast Protein Crystal Imaging

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INVENTORS

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OTHER INFORMATION

KEYWORDS

UV microscope, protein imaging, protein crystallography, light emitting diodes, on-chip microscopes, lens-based microscopy, holographic microscope

CATEGORIZED AS

- **Biotechnology**
  - Bioinformatics
- **Imaging**
  - 3D/Immersive
- **Medical**
  - Diagnostics
  - Imaging
  - Research Tools

RELATED CASES

2019-346-0

SUMMARY

UCLA researchers in the Department of Electrical Engineering have developed an on-chip UV holographic imaging microscope that offers a low-cost, portable, and robust technique to image and distinguish protein crystals from salt crystals.

BACKGROUND

Dual-mode microscopes composed of bright-field and ultraviolet (UV) induced fluorescence modes are an important tool for imaging protein crystals and distinguishing them from salt crystals. These dual-mode optical microscopes are sensitive enough for protein and salt crystal distinction. However, these microscopes require UV-grade optics, which are relatively bulky and expensive. Moreover, applying lens-based microscopy to conventional UV microscopes has a trade-off between the field-of-view (FOV) and resolution, which limits the total sample area that can be imaged.

INNOVATION

UCLA researchers have developed an on-chip UV holographic imaging microscope that offers a low-cost, portable and robust technique to image and distinguish protein crystals from salt crystals without the need fot expensive and bulky optical components. The UV transmission images are captured over a large FOV that is only limited by the sensor active area (>10 square mm). The device does not require fine alignment and possesses high temperature stability, unlike its lens-based counterparts. Thus, this on-chip UV holographic microscope could serve as a low-cost, sensitive and robust alternative to conventional lens-based UV-microscopes used in protein crystallography. Moreover, it is expected that this portable on-chip UV holographic imaging platform could be even further improved with near real-time imaging capabilities, driven by future improvements in deep UV LED power output and the increasing availability of embedded graphics processing units (GPUs) for single-board computers.

APPLICATIONS

- UV microscopes
- Protein Crystallography
- Pharmaceutical quality control
- Semiconductors and Displays: High-resolution imaging, OLED development, microfluidic device development

ADVANTAGES

- Low cost, portable, and robust
- Large FOV limited only by the sensor active area
- Does not require fine alignment and no temperature stability issues

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20220113671	04/14/2022	2019-346
European Patent Office	Published Application	3891560	10/13/2021	2019-346

RELATED MATERIALS

- Daloglu, M.U., Ray, A., Gorocs, Z., Xiong, M., Malik, R., Bitan, G., McLeod, E. and Ozcan, A., 2017. Computational On-Chip Imaging of Nanoparticles and Biomolecules using Ultraviolet Light. Scientific reports, 7, p.44157.

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Automated Semen Analysis Using Holographic Imaging
- Extended Depth-Of-Field In Holographic Image Reconstruction Using Deep Learning-Based Auto-Focusing And Phase-Recovery
- Detection and Spatial Mapping of Mercury Contamination in Water Samples Using a Smart-Phone
- Computational Cytometer Based On Magnetically-Modulated Coherent Imaging And Deep Learning
- Lensfree Tomographic Imaging
- Single Molecule Imaging and Sizing of DNA on a Cell Phone

- Cross-Modality Deep Learning Brings Bright-Field Microscopy Contrast To Holography
- Microscopic Color Imaging And Calibration
- Quantification Of Plant Chlorophyll Content Using Google Glass
- Rapid, Portable And Cost-Effective Yeast Cell Viability And Concentration Analysis Using Lensfree On-Chip Microscopy And Machine Learning
- Holographic Opto-Fluidic Microscopy
- Design Of Task-Specific Optical Systems Using Broadband Diffractive Neural Networks
- Ultra-Large Field-of-View Fluorescent Imaging Using a Flatbed Scanner
- Revolutionizing Micro-Array Technologies: A Microscopy Method and System Incorporating Nanofeatures
- Tunable Vapor-Condensed Nano-Lenses

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