In-Situ TEM Holder With STM Probe And Optical Fiber

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OTHER INFORMATION

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Imaging**
  - Other
- **Nanotechnology**
  - Electronics
  - Materials
  - Tools and Devices
- **Semiconductors**
  - Testing
- **Sensors & Instrumentation**
  - Physical Measurement
  - Scientific/Research
- **Engineering**

» Other

BRIEF DESCRIPTION

Researchers at UCI have developed a fully integrated sample mount for the simultaneous high-resolution imaging and electronic and optical characterization of thin film devices.

RELATED CASES

2018-076-0

FULL DESCRIPTION

Transmission electron microscopy (TEM) is a powerful technique which uses a beam of electrons, instead of light, to image a specimen. As such, TEM is capable of resolving objects that are over a thousand times smaller than those resolvable under standard light microscopes (~0.2 nm vs 200 nm, respectively). This high resolution has made TEM an indispensable characterization tool across a wide range of fields – in fact, the 2017 Nobel Prize in Chemistry was awarded for developments in cryo-electron microscopy of biomolecular samples.

One of the more common applications of TEM is in the characterization of electronic and photovoltaic devices, such as thin film sensors and solar cells. As recent advances in fabrication techniques have allowed for the miniaturization of such devices, the high-resolution imaging afforded by the TEM makes it an ideal candidate for probing micro- and nano-scopic layers and boundaries. Such aspects can shed light into device functionality and efficiency. To fully characterize these devices, however, their electronic and/or photovoltaic responses must also be determined. Ideally, such measurements should be done in situ on the fully intact device and in conjunction with TEM imaging. Such an experiment would require a highly specialized TEM sample holder which is compatible with a variety of sample types and allows for simultaneous electronic and photovoltaic measurements.

To this end, researchers at UCI have developed an integrated platform to meet these needs. The device consists of a double-tilt TEM holder, which contains and electric probe and embedded fiber optic cable. The probe allows an electric bias to be applied to the sample for electronic measurements, such as scanning tunneling microscopy. The fiber optic connects to an external light source and photodetector, for photovoltaic characterization via cathodoluminescence experiments. Unlike other similar TEM stages on the market, this holder is compatible with a variety of sample geometries, including thin films, and allows for precise control of both the stage and electric probe positioning.

SUGGESTED USES

For the in situ imaging and electronic/optical characterization of electronic and photovoltaic devices

ADVANTAGES

» Multifunctional: The sample holder is fully integrated, and provides simultaneous high resolution imaging as well as electronic and optical characterization of a sample.

» Precise: The positioning of both the TEM sample stage and the electronic probe can be precisely controlled.

» Universal: Unlike other in situ TEM holders, the double-tilt control afforded by the proposed technology makes it highly compatible with a number of sample geometries, including ubiquitous thin film devices.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,520,527	12/31/2019	2018-076

STATE OF DEVELOPMENT

Currently in the working prototype stage.

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