DIRECT OPTICAL VISUALIZATION OF GRAPHENE ON TRANSPARENT SUBSTRATES

Tech ID: 25939 / UC Case 2016-191-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,989,668	04/27/2021	2016-191

BRIEF DESCRIPTION

The ~ 10% optical contrast of graphene on specialized substrates like oxide-capped silicon substrates, together with the high-throughput and noninvasive features of optical microscopy, have greatly facilitated the use and research of graphene research for the past decade. However, substantially lower contrast is obtained on transparent substrates. Visualization of nanoscale defects in graphene, e.g., voids, cracks, wrinkles, and multilayers, formed during either growth or subsequent transfer and fabrication steps, represents yet another level of challenge for most device substrates.

UC Berkeley researchers have developed a facile, label-free optical microscopy method to directly visualize graphene on transparent inorganic and polymer substrates at 30−40% image contrast per graphene layer. Their noninvasive approach overcomes typical challenges associated with transparent substrates, including insulating and rough surfaces, enables unambiguous identification of local graphene layer numbers and reveals nanoscale structures and defects with outstanding contrast and throughput. We thus demonstrate in situ monitoring of nanoscale defects in graphene, including the generation of nano-cracks under uniaxial strain, at up to 4× video rate.

SUGGESTED USES

» Ultrahigh-throughput, ultrahigh-contrast, label-free inspection of the quality of graphene for nanoscale defects over large areas

» Locating and identifying graphene films or pre-patterned graphene structures during fabrication (e.g, photolithography)

» Characterization of nanoscale defects in graphene

ADVANTAGES

» High throughput inspection at 4× video rate.

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INVENTORS

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OTHER INFORMATION

KEYWORDS

graphene, nanoscale defects, transparent substrate, microscopy, silicon substrate

CATEGORIZED AS

» **Optics and Photonics**
» All Optics and Photonics
» **Computer**
» Other
» **Imaging**
» Other
» **Materials & Chemicals**
» Chemicals
» Thin Films
» **Nanotechnology**
» Electronics

RELATED CASES

2016-191-0

» Optical contrast of up to 42% for monolayer graphene on transparent substrates

» Not prone to sample damage

» No fluorescent coating is required

PUBLICATION

Direct Optical Visualization of Graphene and Its Nanoscale Defects on Transparent Substrates

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Facile, Excitation-Based Spectral Microscopy For Fast Multicolor Imaging And Quantitative Biosensing
- Superresolution Microscopy And Ultrahigh-Throughput Spectroscopy
- SpeedyTrack: Microsecond Wide-field Single-molecule Tracking

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