Graphene Neural Sensors for Next Generation In Vivo Imaging and Optogenetics

[Thursday Keynote]

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ABSTRACT

Graphene has been studied extensively for their properties in the electrical, mechanical, and optical domains. Graphene's flexible, transparent, and bio-compatible characteristics expand its boundaries from electrical applications to biological applications. Here, we present graphene neural sensors that allow for next generation in vivo imaging and optogenetics for its transparency over a broad wavelength spectrum and ultra-mechanical flexibility. The neural sensors implanted on the brain surface in rodents verify their unique abilities, including see-through in vivo imaging via fluorescence microscopy and 3D optical coherence tomography, and performance in advanced optogenetic experiments. The study is expected to deliver key information regarding the use of graphene in biological environments, specifically the brain. Subsequently, the study will have a strong impact on a wide spectrum of research areas spanning electrical engineering, neural science, and neural engineering.

Categories and Subject Descriptors

A.0 [**General Literature**]: GENERAL—*Conference proceedings*

General Terms

Keynote

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BIOGRAPHY

Zhenqiang (Jack) Ma received his Ph.D. degree in electrical engineering from the University of Michigan in 2001. Before he joined the faculty at the University of Wisconsin-Madison in 2002, he worked for Conexant Systems and Jazz Semiconductor. He is recognized as a Lynn H. Matthias Professor in Engineering and Vilas Distinguished Achievement Professor in the Department of Electrical and Computer Engineering, with affiliated appointments in Nuclear Engineering, Engineering Physics, Materials Science Program, and UW Energy Institute. His research interests cover semiconductor materials and heterogeneous integration, device physics and technologies, and their applications to electronics, optoelectronics, nanophotonics, energy conversion, bioelectronics, biomimetics, power electronics, and sensors for nuclear materials. He has published over 330 peer-reviewed technical papers related to his research. He received the PECASE, DARPA Young Faculty Award in 2008 and several awards from the University of Wisconsin. He holds 25 US patents.

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