NETPORE
Network on porous semiconductors and oxides

PRESENTER INFORMATION

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BIOGRAPHICAL SKETCH

Dr. Borenstein finished his PhD in Chemistry with distinction at Bar-Ilan University in 2016, researching carbon-based composite materials for super- and pseudo-capacitors. He then received the Israeli Ministry of Energy post-doc Fellowship, which he conducted at UCLA, where he further developed carbon-based nanomaterials for energy systems.

Dr. Borenstein's work received the appropriate recognition from the scientific community, and Arie has won several awards and fellowships, including the Schoup Fund for Excellent Researchers and the UCLA-BIU fellowship.

In 2020, Dr. Borenstein joined the Department of Chemical Sciences at Ariel University, where he established the Nano-Carbons and Composites Lab. He investigates different topics in materials sciences, including carbon-based nanomaterials for energy systems, laser-assisted fabrication of 3D graphene, electrocatalysis of hydrogen, ammonia, CO2, and more.

TITLE Recent progress in Laser-induced Graphene

ABSTRACT

To allow the full potential of nanocarbons, simple and scalable synthesis methods are needed. In the past decade, laser-induced carbonization emerged as a simple, eco-friendly, and cost-effective synthesis method of high-grade nanocarbon. A major advantage of laser synthesis is the possibility of fine-pattern film's on-demand applications and tunability with regard to laser wavelengths and energy input. The precursors are directly carbonized on the substrate, and their properties are adjusted by careful selection of the laser parameters. The possibility of patterning enables new potential applications for carbons, such as micro-electronic devices, catalytic electrodes, or electrochemical sensors.
The most studied precursor for the laser-induced reaction is graphene-oxide. Its laser-assisted conversion into reduced graphene oxide (rGO) and the potential applications of its products were comprehensively studied. Upon laser irradiation, oxygen groups and carbon dioxide gas leave the sample with high pressure. The pressure expands the gaps between the sheets and reduces GO (rGO) in the 3D matrix. The produced films demonstrate high surface areas and electrical conductivities.
In recent years, different research groups around the globe have used laser treatment to carbonize and graphitize new materials to overgo the laser reaction. Expanding the range of potential precursors widens the optional properties of the laser-induced carbons. Using laser processing, we successfully developed carbon nanodots, CNT, MOF, and MXene-based composites.

Moreover, the rapid laser reaction results in meta-stable phases, unachievable in traditional methods. The new discoveries open a new horizon for practical and commercial synthesis routes of graphitic-based composited films.