

Electron-beam-induced direct etching of Graphene

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Direct (maskless) lithography on graphene has so far been demonstrated using the high-energy electrons of a transmission electron microscope [1], helium ions of a scanning helium microscope [2] and recently also neon ions [3]. Scanning probe methods using an AFM or STM etch electrochemically [4], while the former methods rely on physical sputtering.

Here we demonstrate direct lithography on single- and bilayer graphene sheets using a scanning electron microscope with a gas injection system. The injection of oxygen gas into the chamber during scanning leads to the formation of reactive species at the focal point of the primary beam. These species then locally etch graphene. The technique has been termed electron-beam-induced etching/oxidation (EBIO/EBIE) and has been shown to work on other carbon-based materials [5-7].

Voltage-contrast imaging techniques are used in conjunction with finite-element simulations of the electrostatics to explain the observed secondary electron intensities and correlate them to the etch profile.

References

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