

Reductive nanometric patterning of graphene oxide paper using electron beam lithography

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This work reports for the first time the development of self-sustained graphene oxide (GO) paper where direct-write Electron Beam Lithography (EBL) was used to create conductive patterns ranging from nano to micro-scale. The GO paper prepared by self-assembly of GO sheets was reduced according to a free pattern chosen to be a series of parallel lines (Figure 1), using different electron doses and beam step sizes in order to effectively obtain a reduced pattern at the GO paper surface.

A meticulous discussion of the characterization results of the GO patterned paper obtained for the different working conditions is presented. Structural analysis of the patterned paper showed that the interlayer distance between GO sheets decreases after reduction, allowing

to increase the Hardness and Young modulus, which enables the manipulation and integration of this material on different devices. Furthermore, we also observed that exposed areas to electron beam reduction process showed an increase in the electrical conductivity of up to 3×10^4 times. This freestanding patterned GO paper may find interesting applications for biosensing applications or 2D template for tissue engineering. The preliminary biological tests performed on this work confirmed the biocompatible nature of the patterned GO paper for future research on the biomedical field.

Reference

Reductive nanometric patterning of graphene oxide paper using electron beam lithography, Carbon, Vol 129, April 2018, Pages 63-75.

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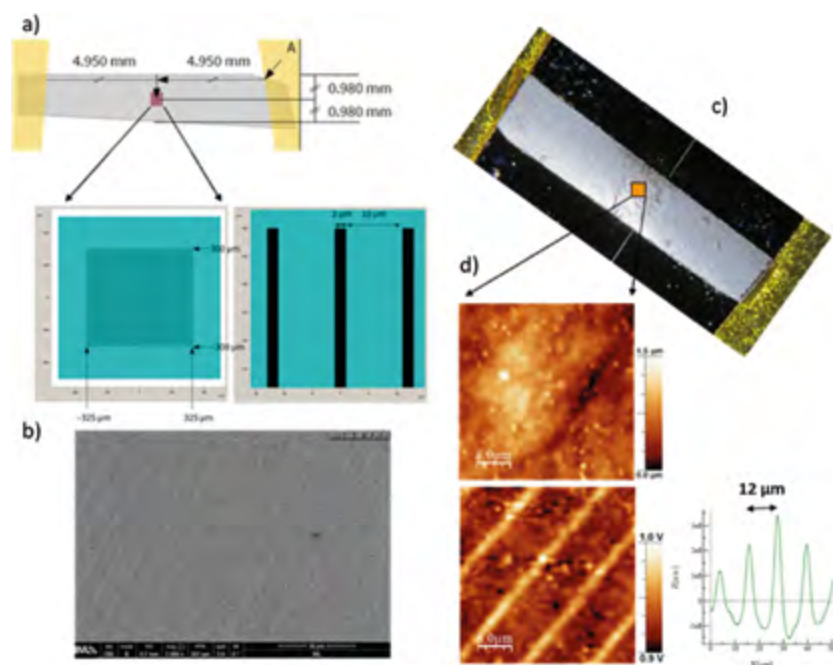


FIGURE 1

a) Schematic representation of the patterned performed on the surface of the GO paper by EBL.
b) SEM image of patterned GO paper.
c) Optical photograph of the exposed area on a strip of the GO paper sample.
d) Atomic force microscopy measurements of the surface potential of the patterned GO paper, showing the predefined center-to-center distance between the reduced lines of 12 μm.