BUSINESS
OPPORTUNITIES

Stamped conductive graphene nano films

a new method for the fabrication and easy patterning of flexible exfoliated graphene nano films for different applications

ICN2 Institut Català de Nanociència i Nanotecnologia

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APPLICATION LANDSCAPE AND NEED

Nowadays great research effort is being made to replace rigid silicon electronics with flexible integrated circuits, with the aim of enabling large-area and low-cost flexible electronics for different applications, such as biomedical, wearable and sensing devices. Great hopes reside on conductive inks printable with high resolution on different substrates.

To this purpose, graphene oxide (GO) is particularly interesting because of its low production cost, easy processibility in water with no need for organic solvents, and quick conversion to conductive reduced graphene oxide (rGO). However, the deposition of rGO in thin films with defined shapes and high accuracy remains a challenge. Most methods employed to produce electrodes and conductive films —such as screen printing, photolithography, spray deposition, inkjet printing— rely on the use of prefabricated moulds or masks and expensive equipment, or require the use of organic solvents to form inks, which may affect or be incompatible with the substrate.

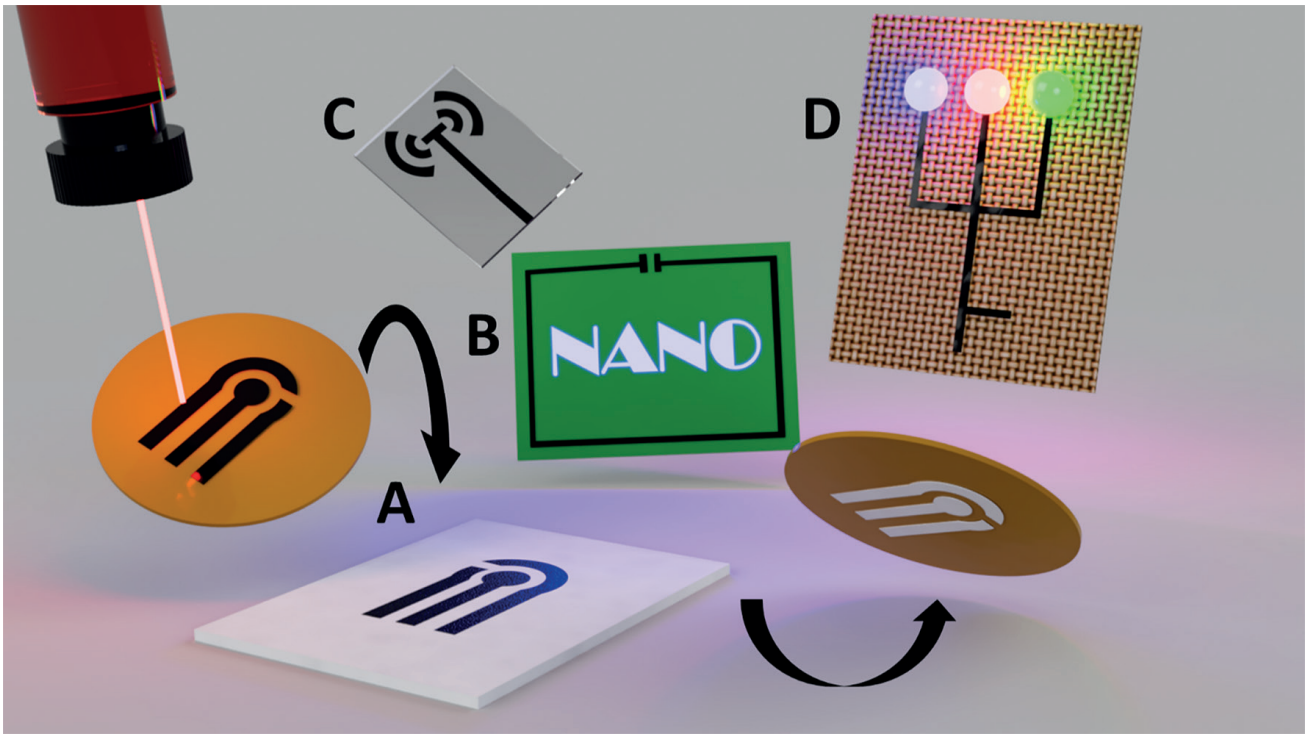
INNOVATION

The ICN2 researchers designed a new method for the fabrication and easy patterning of flexible exfoliated graphene nano films for different applications.

This technique allows the transfer of conductive laser scribed rGO films onto almost any substrate (PET, paper, nitrocellulose, glass, fabric, silicon, skin, etc.). Combining the high resolution laser annealing with the stamping technique, it is possible to produce isolated rGO films up to 30nm thick with a conductivity of 10^2 S/m at room temperature.

This technique has been already applied in the field of sensing and biosensing, where it proved to offer better performance compared to other commonly used materials. Furthermore, **since it is a stamping technique, the substrate is not affected by any solvent or temperature variation**, which increases its usability.

A high-enhanced electroanalytical sensor has been tested and some advantages demonstrated in comparison with classic carbon screen-printed electrodes, namely higher electrical signal and 1-step functionalization.



KEY ADVANTAGES

Some key advantages of our method for rGO patterning are:

- Possibility to use almost any substrate
- High resolution patterning
- No need for predefined masks, allowing any design to be used and quickly modified without additional costs
- Dry transfer (solvent-less)
- Tuneability of the conductivity by modifying laser power and engraving speed
  Low production cost
- Improved conductivity (10^2 S/m at room temperature): a higher signal for electrochemical measurements (4x higher vs carbon screen printed electrodes) can be provided
- No curating process required
- Increased user-friendliness compared with other techniques (inkjet printing, screen printing)

BUSINESS OPPORTUNITY

The emergence of nanotechnology-based sensors is driving the growth of the electrochemical sensor market, which is expected to register a Compound Annual Growth Rate (CAGR) of 11.4% over the forecast period 2019-2024. Indeed, there is a growing demand for modern methods and rapid analysis, both for environmental applications and in clinical diagnosis.

The ICN2 is currently looking for companies that manufacture electrochemical sensors or semiconductors, or point-of-care devices; or partners interested in the development of bio-assays using this technology.

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