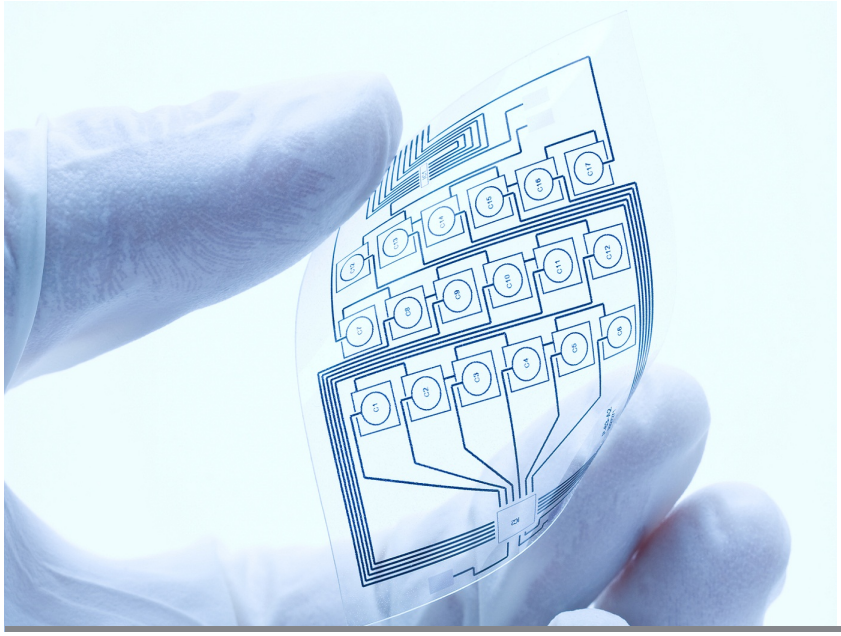


National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Manufacturing

Fabricating printable electronics and biosensor chips

Atmospheric Pressure Plasma Based Fabrication of Printable Electronics and Functional Coatings

NASA has developed a unique approach for an atmospheric pressure plasma-based process for fabrication of printable electronics and functional coatings. The need for low-cost and environmentally friendly processes for fabricating printable electronics and biosensor chips is rapidly growing. This plasma-based fabrication involves aerosol-assisted room temperature printing in which an aerosol carrying the desired material for deposition is introduced into a cold plasma jet operated at atmospheric pressure. The deposition is the result of the interaction of the aerosol containing the precursor material with the atmospheric pressure plasma containing a primary gas. Aerosol-assisted plasma deposition is a high throughput and facile process for printing and patterning that is easily scalable for industrial production. Multiple jets can be used for depositing different materials and the approach can be adapted to a variety of platforms and coating a variety of materials.

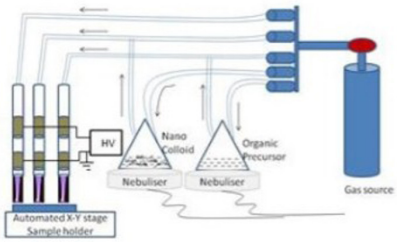
BENEFITS

- Low-cost manufacturing of printed electronics/biosensor chips
- Easily scalable for industrial production
- Works in microgravity
- Adapts to a variety of materials and substrates including flexible substrates

THE TECHNOLOGY

The plasma system consists of a glass tube with a diameter of 0.5 mm or larger, if desired. The electrodes are separated by 10 mm. Helium, argon or cold dry air can be used as a plasma gas source. An applied high voltage between the electrodes causes the gas to breakdown within the central core of the glass capillary generating atmospheric plasma. Nanostructures colloids/organic/inorganic precursors are placed in a glass container with an inlet and outlet for carrier gas and are seated on an ultrasonic nebuliser. The aerosol is then carried into the plasma stream by the carrier gas and is deposited.

The atmospheric plasma deposition system can be modified for depositing multiple materials, either simultaneously or sequentially, and for high-throughput processing by having multiple jets. Each capillary can either be connected to the container containing a single precursor material or to different containers containing different precursor materials to facilitate multiple depositions. The multi-jet plasma system can be automated and controlled individually to precisely control surface characteristics. This technique is independent of the chosen substrate, and has proven to work for many substrates, including paper, plastic, semiconductors and metals.



Pressure plasma jet system

APPLICATIONS

The technology has several potential applications:

- Biomedical technology
- Consumer electronics, e-paper
- Intelligent / Security
- Communications

PUBLICATIONS

Patent No: 11,802,337

Patent Pending

technology.nasa.gov

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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More Information

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