Illinois Team Advances Resolution of E-Jet Printing

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Researchers at the **University of Illinois** (Champaign-Urbana, Ill.) reported that they have improved e-jet printing, which is used to create large-area circuits, displays and photovoltaic modules, among other applications. By combining electrically induced fluid flow with nanoscale nozzles, the researchers said their work has improved the resolution and precision control compared with existing methods.

John Rogers, a professor of materials science and engineering, said the electrohydrodynamic jet printing processes can produce “functional devices that establish new resolution benchmarks for liquid printing.”

The technique can be used for printing microarrays of DNA spots for bioanalysis, carbon nanotubes and other classes of nanomaterials that are difficult to pattern. Unlike conventional ink-jet printers, which use heat or mechanical vibrations to launch liquid droplets through a nozzle, e-jet printing uses electric fields to pull the fluid out.

In work conducted at the university’s **Center for Nanoscale Chemical Electrical Mechanical Manufacturing Systems**, the team developed a gold-coated microcapillary nozzle with a diameter as small as 300 nm, mounted on a computer-controlled mechanical support. An organic Teflon-like coating on the gold ensures the ink flows cleanly out the nozzle toward the target. Droplets of ink eject onto a moving substrate to produce printed patterns. Lines can be printed with widths as narrow as 700 nm and dots as small as 250 nm.

In a demonstration, the research team used e-jet printing to create thin-film transistors that use aligned arrays of single-walled carbon nanotubes.

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Source and drain electrodes were printed on flexible plastic substrates. The transistors were fully operational, with properties comparable with similar devices fabricated with conventional photolithographic methods, according to the university.

The approach can be extended to a wide variety of functional organic and inorganic inks, including suspensions of solid objects and silicon rods.

A paper on the work was published in the **August issue of Nature Materials**.

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