Breakthrough reported in transconductance in ink-jet printing

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MRS Communications, the recently launched journal from the Materials Research Society and Cambridge University Press, was designed to serve the fast-moving international materials research community.

The inaugural Rapid Communications article details an important breakthrough by a team of Japanese and German researchers.

The researchers report that they have successfully achieved a transconductance of 0.76 S/m for organic thin-film transistors with 4 V-operation. The team writes: “This is the highest transconductance reported for organic TFTs fabricated using printing, to the best of our knowledge.”

The transconductance report is the first in the new journal’s Rapid Communications section (which is the concise presentation of a study with broad interest showing novel results).

The first published paper shows that, thanks to ultra-low volume (subfemtoliter) inkjet nozzles, small transistors (channel length ~ 1 μm) were fabricated using electrodes printed from nanoparticle metal inks.

The small dimensions allowed the authors to demonstrate low-power and high-speed operation (theoretically up to a few MHz) of organic transistors, a requirement for useful circuits.

The researchers go on to show that organic and printed electronics are

not limited to large and slow devices, but can be extended to fast and miniaturized circuits while remaining compatible with low-cost fabrication on cheap flexible substrates.

In general, these capabilities widen the spectrum of potential applications of this technology.

More information: Low-voltage organic transistor with subfemtoliter inkjet source–drain contacts,

Abstract

We have successfully achieved a transconductance of 0.76 S/m for organic thin-film transistors with 4 V operation, which is the largest value reported for organic transistors fabricated using printing methods. Using a subfemtoliter inkjet, silver electrodes with a line width of 1 μm and a channel length of 1 μm were printed directly onto an air-stable, high-mobility organic semiconductor that was deposited on a single-molecule self-assembled monolayer-based gate dielectric. On reducing the droplet volume (0.5 fl) ejected from the inkjet nozzle, which reduces sintering temperatures down to 90 °C, the inkjet printing of silver electrodes was accomplished without damage to the organic semiconductor.

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