Ultra-Conformable Circuits Based on MoS_2 Transistors and High-Precision Printing Technologies

Gianluca Fiori
Riccardo Sargeni, Elisabetta Dimaggio, Francesco Pieri, Federico Parenti

Dipartimento di Ingegneria dell'Informazione, Universita' di Pisa, Via Caruso 16, 56122, Pisa, Italy
gianluca.fiori@unipi.it

We present a hybrid technology platform for the fabrication of ultra-thin, mechanically conformable, and electrically performing field-effect transistors (FETs) based on monolayer MoS_2. These devices exhibit robust performance under strong bending and adhere to irregular and dynamic surfaces such as leaves, fruit skins, and contact lenses, demonstrating their potential for wearable and implantable electronics. Our fabrication strategy combines mechanical patterning, solution processing, and inkjet printing, resulting in high-density (≈100 devices/cm²) FET arrays. We demonstrate both digital and analog circuits—including inverters and NAND gates—highlighting the technology's readiness for integrated system applications. The devices have been fabricated through a high-resolution printing platform that integrates inkjet and dip-pen nanolithography (DPN) capabilities. This tool allows for additive and subtractive patterning with micrometric precision, enabling the fabrication of short-channel MoS_2 FETs even on paper substrates. The system's flexibility and resolution surpass conventional commercial printers without the need for modified inks or cartridges, offering an efficient route toward scalable, low-cost, and sustainable electronics.

References

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Figures

Figure 1: Fabricated transistors deployed on top of a leaf.