TERAHERTZ ELECTRONICS

Nanoplasma speeds up switching

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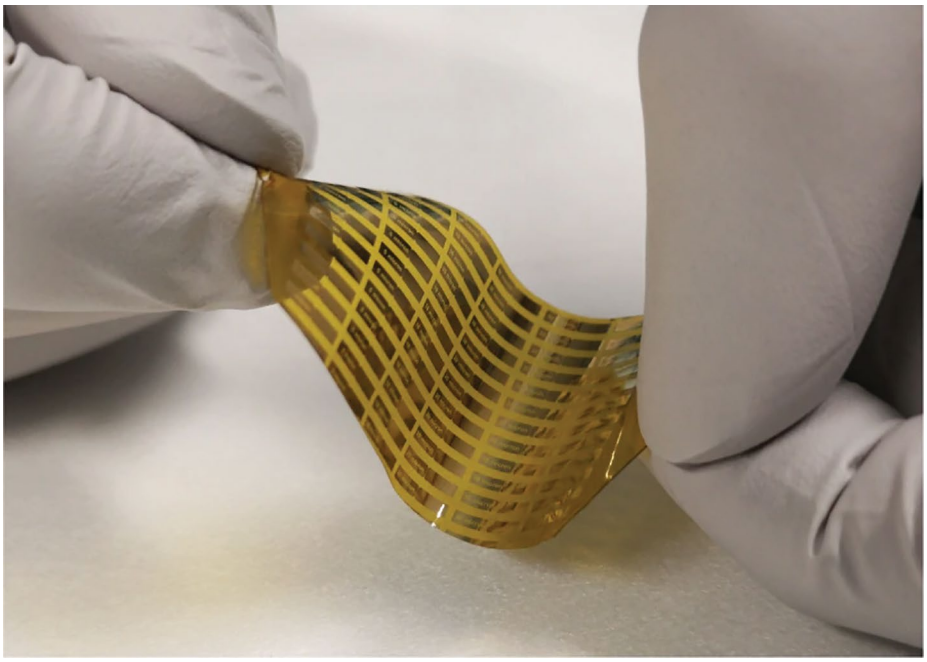

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The switching speed of a transistor is a key metric and is limited by the capacitance of the device. As traditional transistors have shrunk, the highest achievable cut-off frequency has increased to the terahertz range, opening up many new applications. But the devices are also limited to high-frequency, low-power output due to their power–frequency limit. Elison Matioli and colleagues at the École Polytechnique Fédérale de Lausanne have now developed flexible plasma-based switches that operate with picosecond speeds and high power levels.

The researchers created a device that consists of two lateral metal contacts separated by a gap. When a voltage is applied, a nanoscale plasma forms in this gap, either by electric-field emission or tunnelling. Because the nanoplasma switches have low parasitic capacitance it can achieve ultrashort rise times of 5 ps. Crucially, the device can perform this switching for signals at higher voltages, which allows it to generate wider bandwidth signals with fewer limits on the power. For example, when using these switches in a terahertz source, Matioli and colleagues attained a power–frequency limit of 600 mW THz^2, which can be compared to the upper limit of 2.5 mW THz^2 for most field-effect transistors.

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