ORGANIC ELECTRONICS

Engineered barriers give transistors stability

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Thin-film transistors can be found in a range of applications including flat panel displays and sensing technologies, and are usually made of inorganic materials like silicon or amorphous oxides. Organic thin-film transistors (OTFTs) offer advantages over such transistors, including relatively low processing temperatures and low fabrication costs, but they have so far had a limited impact on commercial products because of their instability and inferior performance. Bernard Kippelen and colleagues at Georgia Institute of Technology have now developed a modified design approach that can create OTFTs with stabilities comparable to their commercial inorganic counterparts.

The researchers focused on optimizing the geometry of the dielectric layer of the transistors, which is between the top gate contact and the bottom electrodes. The fabricated devices were microcrystalline OTFTs with a bilayer gate dielectric that consisted of a fluoropolymer first layer and a metal oxide second layer (itself composed of alternating layers of aluminium oxide and hafnium oxide). The enhanced operation was found to be dependent on the thickness of this nanolaminate oxide layer, though the precise physical mechanism behind the effect remains unclear.

In a series of stability tests, the transistors were shown to retain good electrical properties over an extended period of time, as well as under humid conditions and after being immersed in water. In particular, the transistors exhibited voltage threshold shifts that were similar to or smaller than those reported for inorganic thin-film transistors.

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