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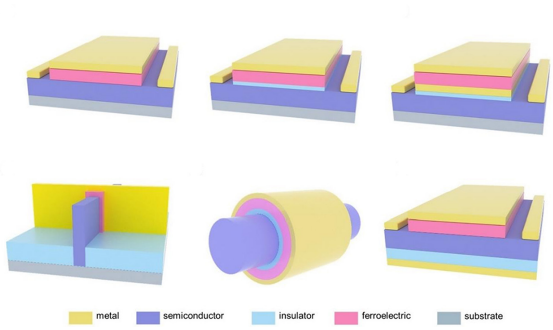
Thin-film field-effect transistors provide unique benefits in electronics research.



Ferroelectric materials are a unique class of compounds with applications in electronics, sensing, and energy storage. Their polarization properties make them well-suited as memory devices, especially as thin-film ferroelectric field-effect transistors (FeFETs). In these devices, the thin-film ferroelectric is paired with a semiconductor substrate, and the overall quality of the device depends heavily on this interface.

Jiao et al. discuss the history of FeFETs, their design considerations and fabrication methods, and applications in electronics and optoelectronics. They intend to provide an overview of possibilities for researchers looking to explore the field.

“Our work covers areas such as memories, logic devices, photodetectors, sensors, and artificial intelligence devices,” said author Jianlu Wang.

Because the ferroelectric-semiconductor interface is so crucial, the authors describe several material and design possibilities to suit different applications. For each application, they showcase how carefully chosen materials can exhibit desirable properties and achieve high performance. For instance, FeFETs can be used in low-power logic circuits, their optical sensitivity makes them a good choice for sensors, and they make highly stable memory circuits for military and aerospace applications.

The team concludes with a discussion on future directions for FeFET research. They propose methods to improve homogeneity in films, techniques to further harness the unique properties of ferroelectric materials, and new combinations with semiconductors for advanced applications.

“We think that FeFETs are very promising in new photodetection devices and artificial intelligence devices,” said Wang. “However, how to construct related device models to improve device performance or expand functions is the key.”

Source: “Ferroelectric field effect transistors for electronics and optoelectronics,” by Hanxue Jiao, Xudong Wang, Shuaiqin Wu, Yan Chen, Junhao Chu, and Jianlu Wang, *Applied Physics Reviews* (2023). The article can be accessed at https://doi.org/10.1063/5.0090120.