2D material-based memristors for neuromorphic computing

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The exponential growth in digital technology has created unprecedented demand for efficient, high-performance computing. Traditional von Neumann architectures struggle to meet the stringent requirements of modern computing tasks due to the inherent bottleneck between processing and memory. This limitation has fueled growing interest in in-memory computing, where data storage and processing are performed simultaneously, offering a promising solution to the energy and speed limitations of conventional systems. Memristors, resistive switches capable of storing and computing information based on applied voltage or current, stand at the forefront of this innovation. These devices bypass the von Neumann bottleneck, enabling low-power, high-durability neuromorphic computing systems that mimic the human brain's processing capabilities.

Next-generation memristors based on 2D materials offer exceptional potential due to a rich variety of electronic properties and scalability to feature sizes below 5 nm. In this talk, I will present the latest advances in 2D material-based memristors for neuromorphic computing, focusing on their operational mechanisms, performance metrics, and potential impact in energy-efficient and compact devices. The implementation of 2D materials opens new pathways for memristive technologies, provided that the current challenges in material synthesis, device fabrication, and architecture integration are addressed.