frontiers | Frontiers in Nanotechnology

EDITORIAL
published: 25 April 2022
doi: 10.3389/fnano.2022.886586

Editorial: Emerging Neuromorphic Electronics and Materials for Post-Moore Computing Era

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Keywords: neuromorphic computing, non-volatile memory, RRAM, ferroelectrics, two-dimensional materials

Editorial on the Research Topic

Emerging Neuromorphic Electronics and Materials for Post-Moore Computing Era

In the new era of high-performance computation, information technologies have been renovated in a wide range of applications, such as artificial intelligence (AI), machine learning (ML), internet-of-things (IoT), edge computing, in-memory computing paradigm, and hardware security. With the increasing computational demands, the microelectronic technology in devices and materials has been reformed as well as the computer architecture and configurations. The emerging memory technology with high-density storage, large bandwidth, and low power consumption has been rapidly developed over decades, including resistive random-access memory (RRAM), ferroelectric random-access memory (FeRAM), magnetic resistive random-access memory (MRAM), and phase change memory (PCM). As the transistor continues to scale to the physical limit, research on developing and enabling memory with the computing features and ultra-density storage capacity, i.e., synaptic plasticity, multi-level cell (MLC) storage, analogic behaviour etc., has attracted a great amount of attention.

The published papers in this Research Topic include one minireview and four research articles. The review by Beilliard and Alibart, reports summarized advances in multi-terminal memristive devices which enables the synaptic plasticity in neuromorphic computing hardware. Further, a comprehensive overview of RRAM composed of two-dimensional (2D) materials for brain-inspired computing is also presented. The research article by Huang et al., presented the properties and recent developments of a monolayer rhenium diselenide ($ReSe_2$), as a two-dimensional (2D) material, that has been reported to exhibit non-volatile resistive switching (NVRS) behavior in RRAM devices with the scale of sub-nanometer active layer. The research paper by De et al. reports a neuromorphic computational system implementing with Zr: HfO_x-based ferroelectric FET devices and the physical mechanisms are also investigated. The study by Chen, describes graphite-based RRAM devices with self-rectifying characteristic with MLC application as well as the reprogrammable read-only data storage for computing and security applications. The research by Nagarajan et al. presents the power-oriented attacks and corruption of critical spiking neural network (SNN) training parameters and degradation in classification accuracy. This research collection reports the developments on materials, devices, and system-level

Edited and reviewed by:
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Received: *28 February 2022*
Accepted: *14 March 2022*
Published: *25 April 2022*

Citation:
Chen Y-C, Amirsoleimani A and Kabiri Ameri S (2022) Editorial: Emerging Neuromorphic Electronics and Materials for Post-Moore Computing Era. Front. Nanotechnol. 4:886586. doi: 10.3389/fnano.2022.886586

research towards the emerging computational configurations and devices, and further research is needed to achieve practical applications in hardware computing. We sincerely hope that our work on the fundamentals will inspire future experimental explorations in the post-Moore and next generation computing era.

AUTHOR CONTRIBUTIONS

Y-CC, AA, and SK. initiate the journal collection and context. Y-CC. and AA lead the invitations and referrals. Y-CC. managed the manuscript review process.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.