Proc. Natl. Acad. Sci., India, Sect. A Phys. Sci. (July–September 2023) 93(3):423
https://doi.org/10.1007/s40010-023-00845-9

EDITORIAL

Special Isssue on Advances in Memory Materials

Neeraj Khare[1]

Published online: 23 August 2023

Editorial

In recent years due to several emerging technologies like big data and cloud computing, the scale and complexity of data storage have reached an unprecedented peak with a much higher requirement for memory technology. Large storage capacity with lower power consumption, faster switching speed, and higher integration density have become the goals of future memory devices. In order to meet the challenges, there has been considerable progress in exploring new materials and approaches to meet this challenge. Magnetic materials have been in application for memory cells for many years, but in recent years, phase change materials, ferroelectric materials, and oxides exhibiting resistive switching behaviour have been explored. Observation of resistive switching in a single three-layer structure (metal/insulator/metal) has opened a new direction for developing resistive random access memory (ReRAM) devices. There has also been good attention on memory technologies for brain-inspired computing.

In this special issue, we are presenting a few articles on selected topics of memory materials. Few articles present an overview of the progress in the area and few are the original research papers related to different aspects of memory materials. Udyan Ganguli and co-authors presented an overview of emerging materials for advanced brain-inspired computing technologies. They presented various non-volatile memories to mimic synapse and neuron functionalities as required for neuromorphic computing. Pranab Kishor Muduli and co-authors presented a review of the recent advancement in binary Kagome magnets for use in emerging efficient, fast, and reliable memory technologies with a focus on spin–orbit torque switching and manipulation of skyrmions. Anjan Barman and Chandrima Banerjee presented a review on advances in optical spintronic memory. Alok Kanjilal and co-authors reported their recent research work on the observations of multilevel switching and reduction in required power for threshold switching in N-GaSb phase change material. Hussain and co-authors presented the use of natural materials for non-volatile memory devices to address environmental problems. Arbinda Haldar and co-authors reported the study of magnetization dynamics of domain walls in cylindrical nanowires. Vijayanandhini and co-authors also reported their study on the domain wall motion in ferromagnetic nanostructures. Resistive switching in oxides is another promising approach for future memory devices. Tapobrata Som and co-authors explored the defect-driven memristor synapses at the nanoscale for potential application in neuromorphic computing. Sandeep Munjal and co-authors investigated $NiFe_2O_4$ for multilevel resistive switching and controlled self-compliance filamentary memory behaviour.

We hope this special issue will inspire researchers to make further contributions in this promising area of memory materials.

✉ Neeraj Khare
Neeraj.Khare@physics.iitd.ac.in

[1] Physics Department, IIT Delhi, New Delhi, India