Call for Papers

Journal of Electroceramics

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Special Issue on Resistive Switching: Oxide Materials, Mechanisms, Devices and Operations

Background and Topics

Redox-based resistive switching memories (ReRAM) are considered by the technological roadmap (ITRS) as a promising technology for novel types of nanoelectronic devices such as memories, memristors, and switches for logic and neuromorphic computing circuits beyond the von Neumann concept. ReRAM shows outstanding potential for scaling down to the atomic level, low-power consumption, fast operation in the nanosecond range and non-volatile storage. ReRAM switching relies on ionic transport taking place within a thin solid film sandwiched between two metal electrodes. By applying a bias between the metal electrodes, the resistance of the device can change abruptly, or switch, from a low-resistance state (LRS, or ON state) to a high resistance state (HRS, or OFF state). This is usually referred to as the ‘set’ transition, while the opposite ‘reset’ transition from LRS to HRS takes place similarly upon application of an opposite voltage. Depending on the physical process involved in the resistance transition, the switching can be a filamentary type or surface area type. The materials used as solid-state electrolytes for ion transport can range from classical ionic or mixed ionic-electronic conductors (e.g., AgI, RbAg$_4$I$_5$, Ag$_2$S, Cu$_2$S) to semiconducting (e.g., Si) or oxide materials (e.g., LaMnO$_{3-x}$, SrTiO$_3$, TiO$_2$, Ta$_2$O$_5$, GeS$_x$, Al$_2$O$_3$). All these materials reportedly support ionic or mixed ionic-electronic transport, leading to repeatable and controllable resistive switching phenomena as a result of redox reaction and ionic motion at the nanoscale. The high-speed, low-power and scalable operation of ReRAM promises to revolutionize the scenario of memory and computation in the semiconductor industry. ReRAMs are expected to provide a solution for high-density storage in portable computers, such as tablets and smartphones, as well as serve as embedded memories in ubiquitous systems for the Internet of Things. The controllable resistance also makes ReRAM an ideal electronic synapse for neuromorphic computing networks capable of bio-inspired cognitive functions, such as machine learning and pattern recognition.

In the recent years many details on the microscopic switching mechanisms have been revealed. However, a deeper understanding and improved physical models are essential to enable development of high performance technology for future ReRAM devices. The influence of the type of ionic carriers, their mobility, the role of the local chemical composition and environment are some of the issues to be addressed. The effects of the composition and structure at different length scales (e.g., crystalline vs amorphous phases, impact of extended defects such as dislocations and grain boundaries) also require an improved understanding. This will help the community in solving
technological challenges related to device integration, 3D architectures, and device performance improvements (e.g., resistance window, endurance, retention, multilevel switching) for the future development of this technology.

In this issue, we invite contributions addressing all issues above from various perspectives, such as those related to the fabrication, characterization, modeling and performance of memristive and related memory devices. Specific topics include, but are not limited to, the following:

- Role of defects – zero, one and two dimensional
- Diffusive processes at room temperature
- Materials and materials combination in resistive switching
- Defect kinetic models for switching
- Deposition/fabrication methods
- Tuning thin film microstructures
- Material/device characterization
- Material/device modeling
- Applications in engineering, e.g., novel computing architectures

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Manuscript submission

Manuscripts must be submitted on‐line through the ordinary JECR submission procedure, available at: [http://www.editorialmanager.com/jecr/](http://www.editorialmanager.com/jecr/)

Among the listed submission options, **authors must choose** “SI: Resistive Switching: Oxide Materials, Mechanisms, Devices and Operations”. Instructions for Authors are available at: [http://www.springer.com/materials/optical+electronic+materials/journal/10832](http://www.springer.com/materials/optical+electronic+materials/journal/10832)

Important Dates

- Manuscript submission deadline: August 1st, 2016
- Revisions back to authors: September 15th, 2016
- Submission of final version: October 15th, 2016
- Publication of Special Issue: January 1st, 2017