Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Engineered Uniform Conduction Fronts in Memristive/Memcapacitive Systems PATRICK MICKEL, CONRAD JAMES, Sandia National Laboratories — We introduce here a novel "memristor" design enabling the uniform propagation of the conduction front within the device, improving performance as well as device-to-device consistency. Typically, resistive switching in memristors occurs due to the localized formation of conductive filaments. Electric fields are magnified at filament tips (due to decreased separation, E = V/d), amplifying growth rates for select filaments and producing a localized and highly non-uniform conduction front. However, we show that by incorporating specifically spaced layers with alternating ionic mobilities the electric field magnification can be counterbalanced, resulting in a uniform conduction front. The uniform conduction front lowers device-to-device variability, improves analog tuning and significantly amplifies the memcapacitive properties of the device. These multi-layered engineered nanostructures have potential applications in multi-bit memory storage and neuromorphic computing architectures.

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Date submitted: 27 Nov 2011 Electronic form version 1.4