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Multidimensional information storage in configurational changes of resistive switching filaments PATRICK MICKEL, ANDREW LOHN, CONRAD JAMES, MATTHEW MARINELLA, Sandia National Laboratories — We present a new methodology which enables direct control of the geometry and radial composition of nanoscale filamentary resistive switches, and demonstrate the ability of this technique to store multidimensional information in a single device. Using bipolar, power limited switching (as opposed to the common voltage or current sourcing), we demonstrate individual control over both the radius and the conductivity of the nanoscale conducting filaments which control resistive switching elements. Using this control, we show that degenerate resistances states may be composed of alternate radius/conductivity pairs which require distinct power thresholds to thermally activate resistive switching (thereby constituting 2D storage: R and P, or radius and conductivity). Finally, by implementing a series of alternate polarity power pulses, we show that the radial composition profile within the nanoscale filament may be precisely tuned leading to designed trajectories through P-R space and a third dimension of information storage. Using this technique we estimate that a single resistive switch may realistically supplant as many as 10 digital devices.

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