

A scaling theory for unipolar resistance switching

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We investigate a reversible percolation system showing unipolar resistance switching (URS) in which percolating paths are created and broken alternately by the application of an electric bias. Owing to the dynamical changes in the percolating paths, different from those in classical percolating paths, detailed understanding of the structure is demanding and challenging. Here, we develop a scaling theory that can explain the transport properties of these conducting paths; the theory is based on the fractal geometry of a percolating cluster. This theory predicts that two scaling behaviors emerge depending on the topologies of the conducting paths. We confirm these theoretical predictions experimentally by observing material-independent universal scaling behaviors in URS.