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Evaluation of switchable organic devices for nonvolatile memory applications

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Many organic electronic devices exhibit switching behavior and have therefore been proposed as the basis for a nonvolatile memory technology. In particular, bistable resistive elements, in which a high or low current state is selected by application of a specific voltage, may be used as the elements of a crosspoint memory array. This architecture places very stringent requirements on the electrical response of the individual devices, in terms of on-state current density, switching and retention times, cycling endurance, rectification and size-scaling. In this talk, I will describe the progress that we and others have made towards satisfying these requirements. In many cases, the mechanisms responsible for conduction and switching are not fully understood. In some devices, it has been shown that current flows in a few highly localized regions. These so-called "filaments" are not necessarily metallic bridges between the electrodes, but may be associated with chains of nanoparticles introduced into the organic matrix either deliberately or accidentally. Coulomb blockade effects can then explain the switching behavior observed in some devices.

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