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The Role of Joule Heating and Defect Chemistry in Memristor Modeling BRIAN TIERNEY, HAROLD HJALMARSON, MICHAEL MCLAIN, DENIS MAMALUY, Sandia National Laboratories — Resistive switching in electroformed metal/metal-oxide/metal memristive devices involves the growth and dissolution of conductive filaments within the metal-oxide. These filaments are typically formed/dissolved by applying a voltage pulse of the appropriate polarity across the metal contacts. The induced electric field across the oxide causes Joule heating. This heating is a significant contributor to the migration of lattice defects such as charged oxygen vacancies, which modulate the time-evolution of the conductive filaments, and hence the device resistance. In this talk, continuum calculations are presented that model the temporal evolution of conductive filaments in tantalum oxide devices. The effects of Joule heating, chemical species migration and pulsed ionizing radiation from an external source are included in the model. Interface tunneling current is determined via a WKB model, in conjunction with a lattice defect generation scheme. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contractDE-AC04-94AL85000.

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