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Current-Controlled Negative Differential Resistance Due to Joule Heating In Tio_2 A.M. BRATKOVSKY, Hewlett-Packard Laboratories, Palo Alto, A.S. ALEXANDROV, S.E. SAVEL'EV, Loughborough Inst. Technology, UK, D.B. STRUKOV, UC Santa Barbara, Santa Barbara, R.S. WILLIAMS, Hewlett-Packard Laboratories, Palo Alto — We show that Joule heating causes current-controlled negative differential resistance (CC-NDR) in TiO2 memristive systems by constructing an analytical model of the current-voltage characteristics based on polaronic transport for Ohm's law and Newton's law of cooling and fitting this model to experimental data. This threshold switching is he "soft breakdown" observed during electroforming in TiO2 and other transition-metal oxide based memristors, as well as a precursor to "ON" or "SET" switching of unipolar memristors from their high to their low resistance states. The shape of the V-I curves is a sensitive indicator of the nature of the polaronic conduction, which apparently follows an adiabatic regime [1].

[1] A.S. Alexandrov, A.M.Bratkovsky, B.Bridle, S.E.Savel'ev, D. Strukov, and R.S.Williams, Appl. Phys. Lett. 99, xxx (2011).

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