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Switching and retention characterization of low current TiOx memristive devices FENG MIAO, JOSHUA J. YANG, JULIEN BORGHETTI, MATTHEW D. PICKETT, GILBERTO MEDEIROS-RIBEIRO, R. STANLEY WILLIAMS, Hewlett-Packard Laboratories, Palo Alto, California — To tap into the promising prospects of TiOx based memristive devices for non-volatile memory applications, low current and low power operation are required. Here we report on switching and retention characterization of 50nm x 50nm cross bar devices. Resistances at room temperature in the OFF state reached values of 0.5TOhm with the switching current of sub-5 μA and an OFF/ON ratio of about 100 in steady state. Some basic switching characterizations, including speed, endurance and performance at chip operating temperature (85°C), are studied. Furthermore, upon setting the device to an ON state, the device resistance exhibits a transient phenomenon, which is quite peculiar, including stochastic jumps on the resistance. By comparing with thermally activated conduction and switching behaviors, possible mechanisms of such transient phenomenon will be discussed. By studying the temperature dependence, we also compare the low current switching behavior with virgin state volatile switching and high current stable switching behaviors, which have been observed on the same devices. The different switching mechanisms coexisting in such devices will be discussed, in the context of low current memristors for low power, non-volatile memory applications.

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