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Multiple switching modes and multiple level states in memristive devices FENG MIAO, J. JOSHUA YANG, JULIEN BORGHETTI, JOHN PAUL STRACHAN, M.-X. ZHANG, ILAN GOLDFARB, GILBERTO MEDEIROS-RIBEIRO, R. STANLEY WILLIAMS, Hewlett-Packard Laboratories, Palo Alto, California — As one of the most promising technologies for next generation non-volatile memory, metal oxide based memristive devices have demonstrated great advantages on scalability, operating speed and power consumption. Here we report the observation of multiple switching modes and multiple level states in different memristive systems. The multiple switching modes can be obtained by limiting the current during electroforming, and related transport behaviors, including ionic and electronic motions, are characterized. Such observation can be rationalized by a model of two effective switching layers adjacent to the bottom and top electrodes. Multiple level states, corresponding to different composition of the conducting channel, will also be discussed in the context of multiple-level storage for high density, non-volatile memory applications.

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