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Oxygen Vacancies Diffusion Model for Electric Pulse Resistance Switching in Oxide Based Memory Devices

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Abstract – Maximum 100 words.

The electric pulsed induced resistive switching (RS) in transition metal oxides involves a non-volatile change in the resistance after the application of electrical pulses, and may be a useful effect for next generation of electronic memory devices [1].

Despite a bursting body of experimental data that is rapidly becoming available [1,2] the precise mechanism behind the physical effect of RS remains elusive.

Here, we introduce a model for RS in transition metal oxides which builds on our previous work [3-4]. The model incorporates the migration of oxygen vacancies at the dielectric-electrode interfaces under strong electric fields, and their effect on the local resistivities. The behavior of the model under a typical voltage protocol (Fig.1) qualitatively reproduces non-trivial resistance hysteresis effects reported in the literature [5,6].

Our results further elucidate the role of geometrical symmetry in the device design, and most significantly, clarify the crucial role of Schottky interfaces for the resistive switching effect.

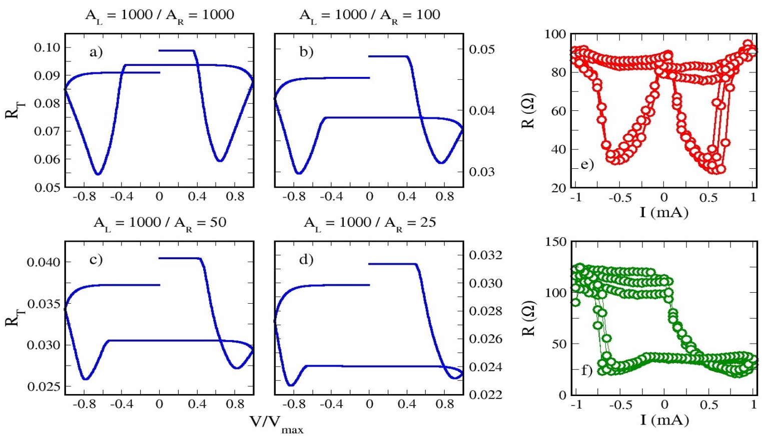

Figure 1: Resistive hysteresis loops obtained for an increasing degree of asymmetry in the dielectric-electrodes interfaces . In the right panels we show the experimental data for two manganite samples, one symmetric (e)) and the other that were rendered asymmetric by means of intense and fixed polarity pulsing (f)). The experimental hysteresis loops were obtained by pulsing in current-control mode, similarly as in Ref.[6]. Notice the qualitative similarity of panels a) and e), and d) and f) respectively.

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