Resistive Switching of $SrIrO_3$ thin films in the vicinity of a Metal Insulator Transition

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The relation between Metal Insulator Transitions (MIT) and Resistive Switching (RS) is important from the fundamental point of view, but also highly relevant because of the possible applications of RS based devices in non-volatile memories [1]. We studied RS of 5d $SrIrO_3$ thin films in the vicinity of a MIT triggered by the reduction of thickness [2]. RS was studied for two characteristic cases: 1. in a thick film which behaves like a semimetal, and 2. in a very thin film which has undergone the MIT and is in an insulating state (see Figure 1). Local electrical properties were measured by means of Conductive Atomic Force Microscopy (C-AFM). In the case of very thin and initially insulating films, I/V curves presented an abrupt increase of the current intensity only for high enough sample voltage indicating a sharp transition into low resistance state (LRS). On the other hand, in the case of initially semimetallic films, this transition was less pronounced without clear threshold voltage for the switching into LRS (see Figure 2). As a result, such different behavior indicates that the MIT has indeed a high impact on the RS. Possible mechanisms of RS in both samples involving oxygen vacancies will be discussed.

References

[1] E. Janod et al., Advanced Functional Materials 25.40 (2015): 6287-6305.
[2] A. Biswas et al., Journal of Applied Physics 116.21 (2014): 213704

Figures

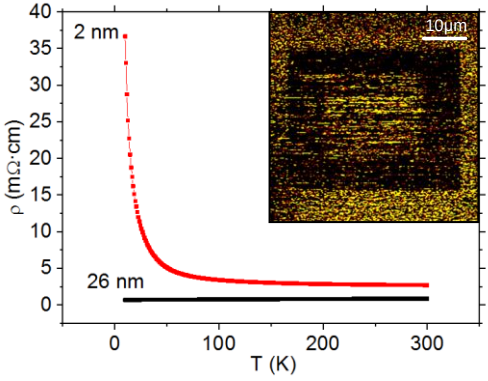

Figure 1: MIT triggered by the reduction of thickness.

Inset: C-AFM current map with a region in the High Resistance State (dark) and a region in the Low Resistance State (inner bright square).

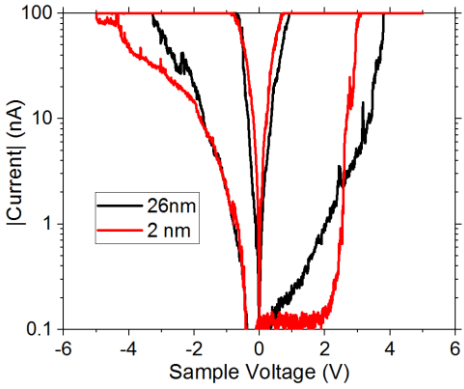

Figure 2: I/V RS curves of 2 nm and 26 nm $SrIrO_3$ thin films.