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# Bipolar resistive switching in cobalt oxide thin film studied by I-V characterization and conductive atomic force microscopy

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Developing new memories, which are high-density, high-speed, low-power-consumption and reliable, are urgent for sustained advances in information storage/processing technologies. Resistive Random Access Memories (RRAMs), which use the characteristic of resistance switching between High Resistance State (HRS) and Low Resistance State (LRS) in a Metal-Insulator-Metal (MIM) structure under applied electrical field, have attracted extensive research interest in recent few decades and have been proved to be a promising category of next-generation Non-Volatile Memories (NVMs). Binary Transition Metal Oxides (TMOs), because of their good compatibility with Complementary Metal Oxide Semiconductor (CMOS) process and simple composition and structure control, have gained considerable attention in RRAMs research. But compared to n-type oxides, studies on the resistive switching properties of p-type oxides, especially on understanding the switching mechanisms, are relatively limited. The exact resistive switching mechanism, to date, is still in debate. Conductive filaments are widely accepted to be the microscopic mechanism for most RS phenomena. However, because of the nanoscale size of conductive filaments, it is usually difficult to observe the filaments directly. In this study, the bipolar resistive switching process and mechanism in Oxygen-Plasma-Assisted Molecular Beam Epitaxy (OPA-MBE) prepared p-type CoO/Pt structures are investigated by both conventional I-V characterization and Conductive Atomic Force Microscopy (CAFM). Bipolar resistive switching behavior is exhibited in the CoO/Pt structures, showing good reproducibility and stability. The Ohmic conduction at LRS indicates the formation of metallic conductive filaments in the set process, which is well consistent to the results in CAFM experiment, in which formation and rupture of conductive filaments are observed in a writing-erasing process. This work not only demonstrates the good potential of cobalt oxide thin films for non-volatile memory application, but also provides more evidence in understanding the bipolar resistive switching mechanism.

## Biography

Jian Yang is currently a Ph.D. student in the School of Materials Science and Engineering, University of New South Wales, Sydney Australia. His research interest is in fabrication of oxide thin films using oxygen-plasma-assisted molecular beam epitaxy, exploring new material systems for resistive random access memories (RRAMs), improving their resistive switching properties and investigating the underlying switching mechanism. Characterization methods include transmission electron microscopy, conductive atomic force microscopy, Kelvin probe force microscopy. etc.

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