Improving the accuracy of defect mobilities and observing interface effects of resistive switching memories using the current transient phenomenon

D.J. Mannion*, W.H. Ng, A. Mehonic, A.J. Kenyon
Department of Electronic & Electrical Engineering, University College London (UCL)
*Correspondence Address: daniel.mannion.13@ucl.ac.uk

1. Motivation
• High density switching memories, hardware accelerators and neuromorphic circuits frequently rely on resistive switching devices or memristors.
• These behaviours arise from the motion of oxygen vacancies within the oxide. It is therefore crucial we understand their properties.
• One possible method to observe vacancy properties is via a phenomenon called the current transient – a characteristic current time response with a prominent current peak.

2. Inducing Transients
• The first challenge was to reliably observe transients in newly fabricated devices. Previously they had only been observed in defective devices.
• We developed a stressing procedure to induce current transients in devices which involved driving a constant current through the device.
• With the ability to induce transients we now turn to their analysis.

3. A Different Analysis
• In existing studies the analysis is based on the timing of the current peak. However, we have developed an alternative method based on our hypothesis that the transient is caused by two separate changes in the oxide.
• We instead fit the transient to two exponential functions allowing us to quantify the rates of the transient in greater detail.

4. Summary & Outlook
• We hope this work is applied to other oxide devices exhibiting transients to evaluate the validity of an SCLC analysis in their own devices.
• In the future, these tools may help reveal alternative methods of determining defect mobilities in MIM devices. But more than this, they may help us explore the transient as a tool in characterising interfaces in a more general sense.