

# **The Role of the Local Chemical Environment of Ag on the Resistive Switching Mechanism of Conductive Bridging Random Access Memories**

## **Supplementary Information**

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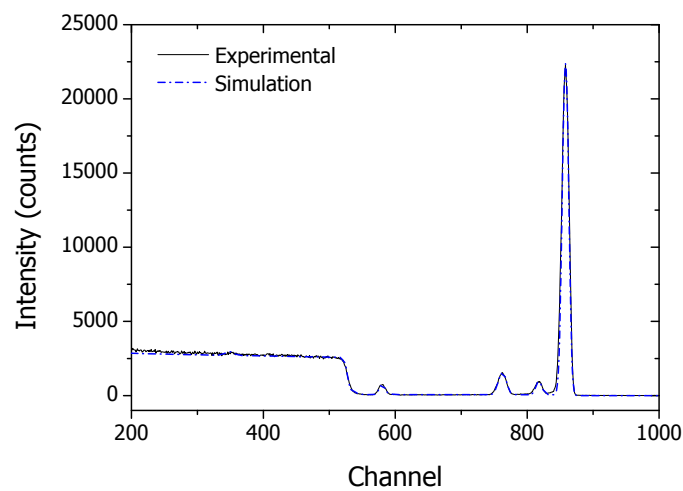
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## I- Rutherford Backscattering Spectrometry (RBS)

RBS was performed on the Van de Graaff ion accelerator of CENBG (Bordeaux, France). The sample was placed in an analysis chamber under a vacuum of  $2 \times 10^{-6}$  torr. The  $^4\text{He}^+$  primary ions were delivered at incident energy of 2.5 MeV and the backscattered particles were detected at  $160^\circ$  from the incident direction. These experimental conditions provided a good depth resolution and allowed the determination of the thin film composition. The surface of analysis was close to  $\text{mm}^2$  (analysis spot allowing centering the beam in the middle of the device).

Figure S1a and S1b show the RBS spectra obtained before and after switching respectively (the experimental and the simulated results are both represented). The concentrations of Ge, S and Ag are presented for both configurations in table S1.

S1a)



S1b)

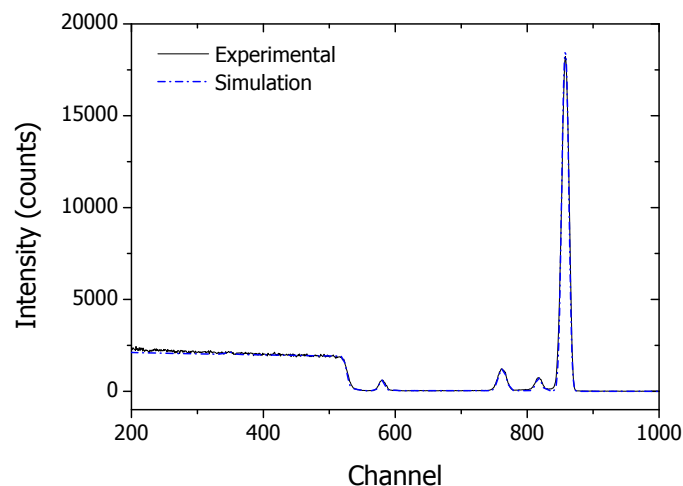


Figure S1a. RBS spectra obtained on the stack  $\text{Ag}/\text{GeS}_x/\text{W}$  before switching and Figure S1b. after switching (10 cycles). The top Ag anode of the CBRAM was completely removed by Ion Beam Etching before RBS analysis.

Table 1. Atomic concentration in Ag/GeS<sub>x</sub>/W before and after switching; the top Ag anode of the CBRAM was completely removed by Ion Beam Etching before RBS analysis.

Sample	Ge (at% ± 3 at%)	S (at% ± 5 at%)	Ag (at% ± 1 at%)	S/Ge Ratio
Before switching	37.6	54.7	7.7	1.45
After switching	37.8	54.5	7.7	1.44

The chalcogenide composition is similar before and after electrical switching cycles. As a result, an S/Ge ratio of  $1.44 \pm 0.25$  with an Ag concentration of  $\sim 8 \pm 1$  at% were obtained in both configurations (before or after electrical switching). We can notice that the presence of Ag atoms in the GeS<sub>x</sub> matrix is generally observed in such structures at room temperature without any treatment. This absence of change in the composition before and after switching can indicate that only a very small material change is involved in the switching mechanism or that the change is not in the area probed by RBS analysis.