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Unlocking the Potential: Harnessing Resistive Memory as a Biosensor

This research explores the transformative potential of resistive memory as a biosensor, delving into its unique properties that enable sensitive and efficient detection of biological analytes. By unraveling the intricate interplay between resistive memory devices and biological interfaces, this research illuminates the promising avenue of utilizing resistive memory as a robust and versatile bio sensing platform. Unlocking this potential not only advances our understanding of the underlying mechanisms but also paves the way for innovative applications in healthcare, diagnostics, and biotechnology. This study marks a crucial step towards harnessing the intrinsic capabilities of resistive memory for biosensing applications, offering new avenues for sensitive and real-time detection in various biological contexts.

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Introduction

The work sets the stage for exploring the untapped possibilities of resistive memory in the realm of biosensing. In recent years, resistive memory devices have garnered attention for their unique electrical characteristics and compatibility with biological interfaces. This study embarks on an investigation into the potential of harnessing resistive memory as a biosensor, aiming to unlock a new frontier in sensitive and efficient biological detection. By bridging the gap between resistive memory technology and biosensing applications, this research seeks to unravel the intrinsic capabilities that could revolutionize healthcare, diagnostics, and biotechnology. As we delve into the synergistic relationship between resistive memory and biological systems, the prospect of a robust and versatile biosensing platform emerges, offering promising avenues for real-time and high-throughput detection in diverse biological contexts. This exploration signifies a pivotal step towards leveraging resistive memory's untapped potential for transformative advancements in biosensing technology.

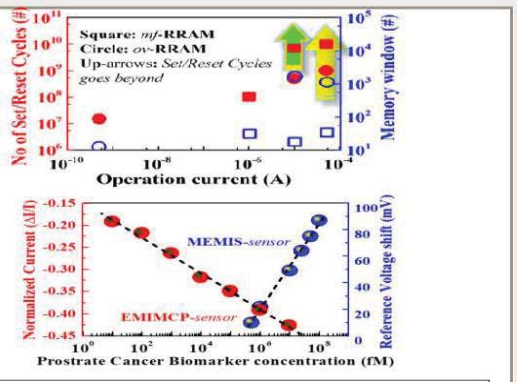


Fig.1 Graphical Abstract of the work

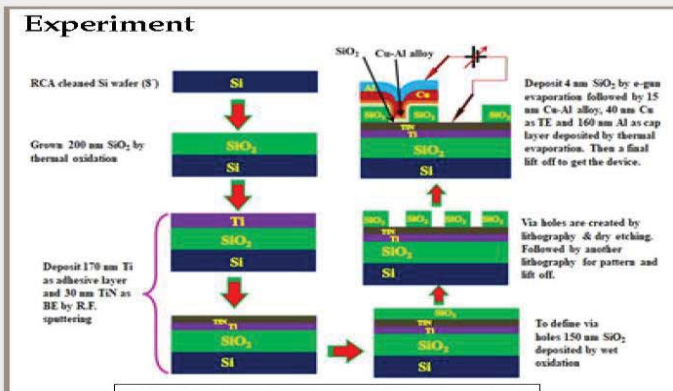


Fig.2 Fabrication Steps for 2D RRAM

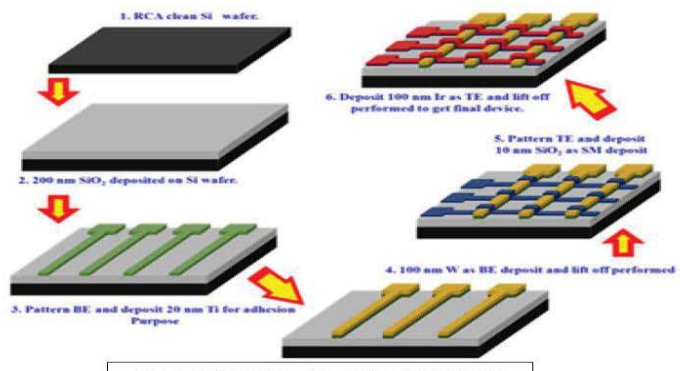


Fig.3 Fabrication Steps for 3D RRAM

Key Findings: Memory

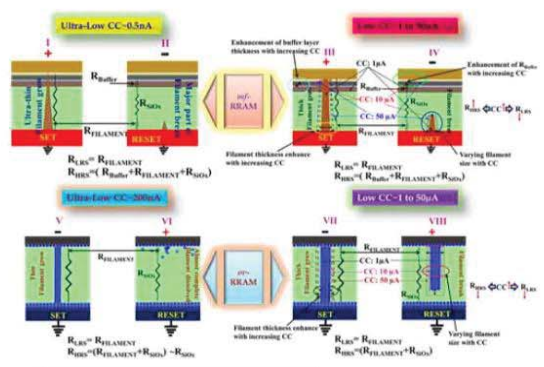


Fig.4 RRAM Operation

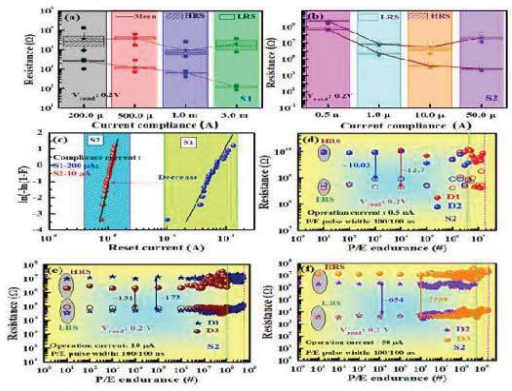


Fig.5 2D RRAM Electrical Data

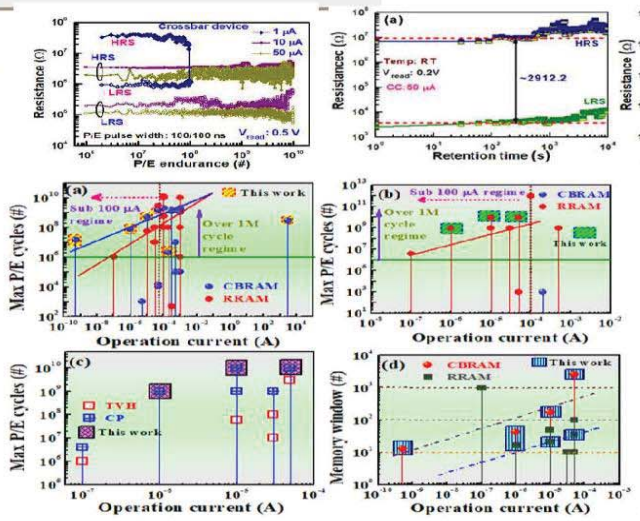


Fig.6 3D RRAM Reliability Data

Fig.7 Memory at a Glance

Key Findings: Biosensor

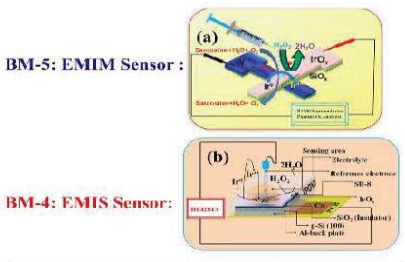


Fig.8 Biosensor measurement

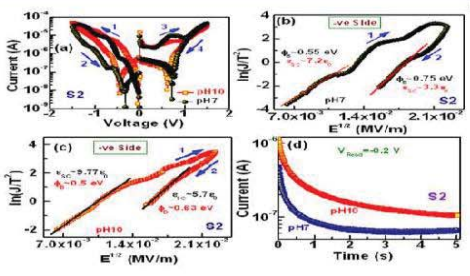
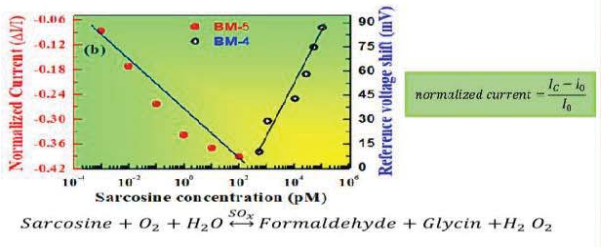


Fig.9 Biosensor IV-t sampling data



$$Sarcosine + O_2 + H_2O \xleftrightarrow{SO_x} Formaldehyde + Glycin + H_2O_2$$

Fig.10 Prostrate Cancer Biosensor Sensitivity data

Conclusion

- ✓ 2D RRAM result lowest R/W energy/bit (5 fJ/bit) & higher memory window (>1000)
- ✓ 3D RRAM show higher R/W cycles (>10^{10} cycles at <100 μA program/erase current)
- ✓ 3D RRAM show ultra-sensitivity with low sample volume for sarcosine detection.
- ✓ SiOx RRAM has excellent potentiality of high density highly reliable memory as well as ultrasensitive prostrate cancer biomarker.