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Design of High-Performance RRAM through Interfacial Engineering Toward Neuromorphic Application by Low-Temperature Plasma-Assisted Selenization Process

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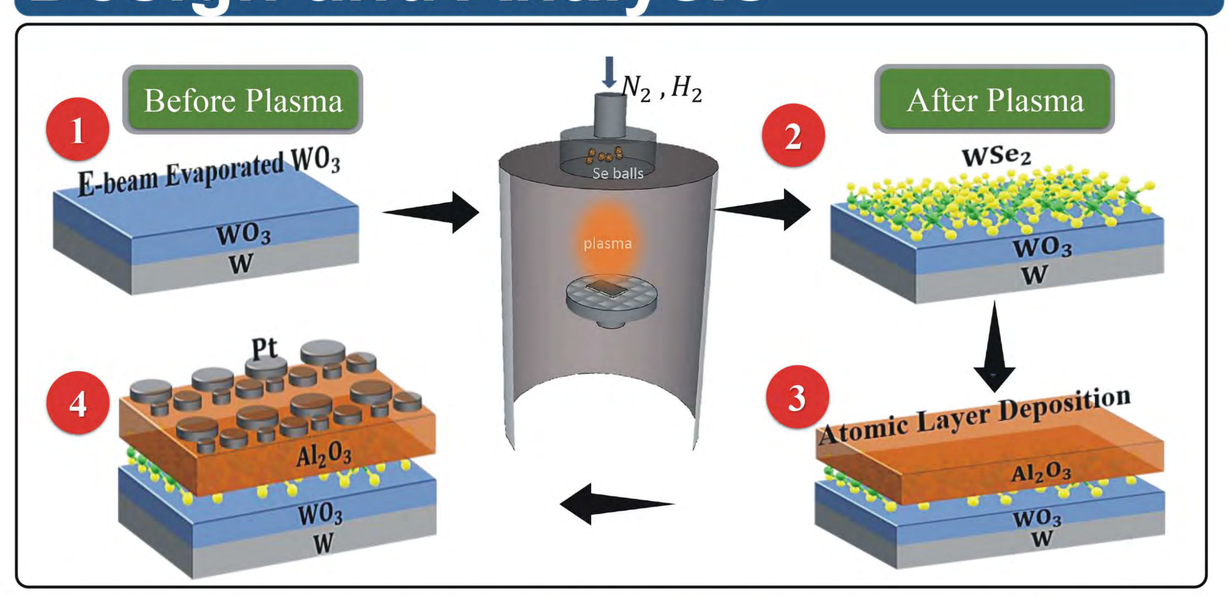
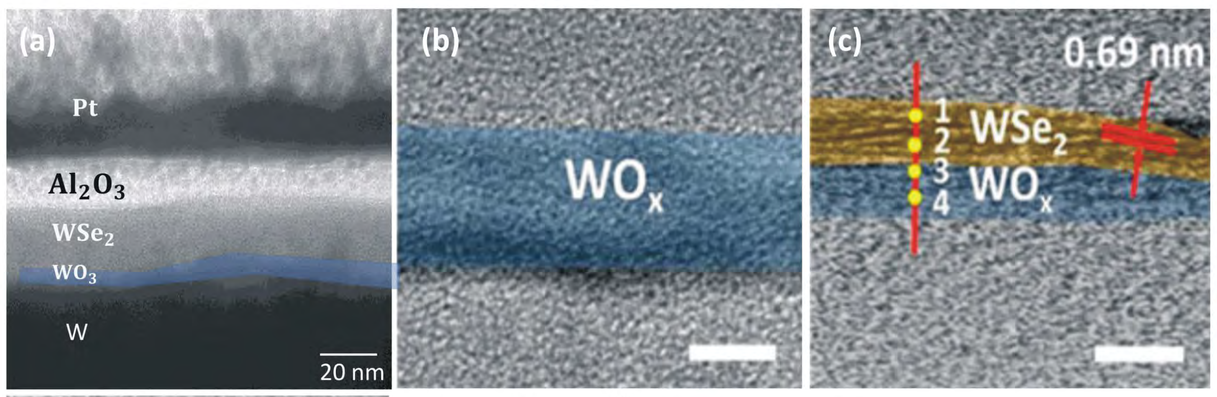
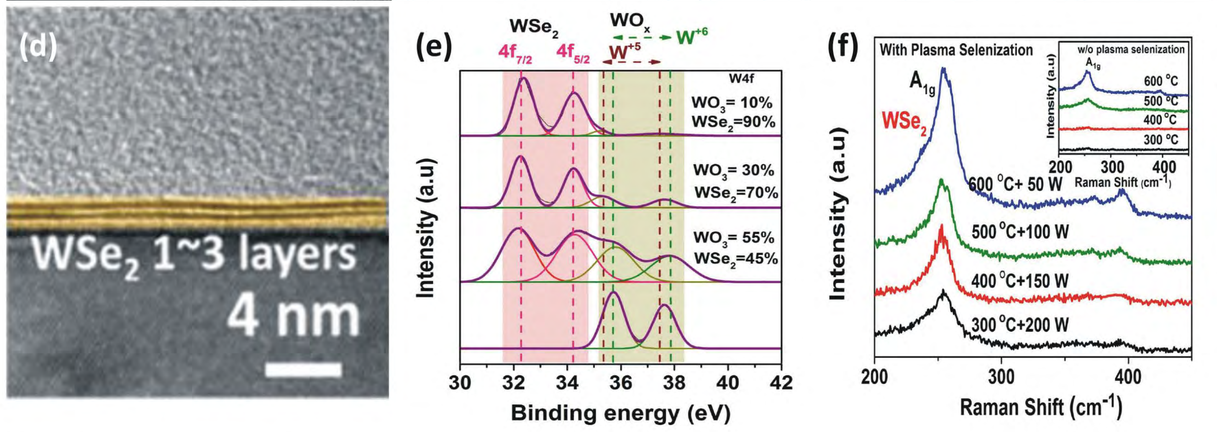
Abstract

The probabilistic formation of conducting filament (CF) in two-terminal Resistive switches affects the device functionality. The spontaneity of formation of CF is the key factor in determining the device reliability and can be controlled by functional layer dynamics near the interface. Here, we propose the interfacial engineering by inserting WO_3/WSe_2 layer between the electrolyte and the active electrode. In addition, inductively coupled plasma (ICP) process was used to change the WO_3/WSe_2 ratio to obtain the high-performance Resistive switch. The use of ICP process facilitates the synthesis of TMD at a temperature as low as 300 ^{0}C. The results indicate that plasma engineered interface engineering can be a promising approach for improved and high-performance RRAM.

Design and Analysis

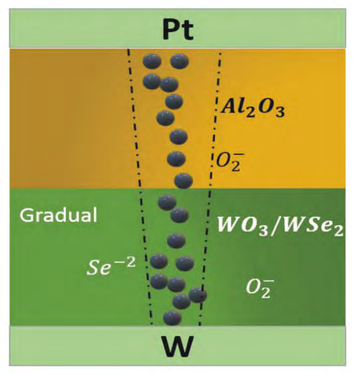


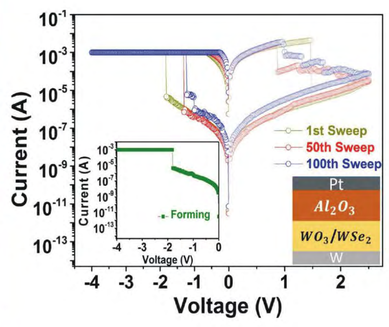


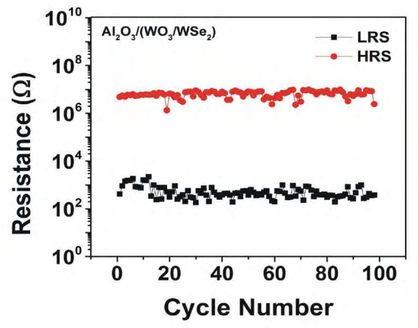


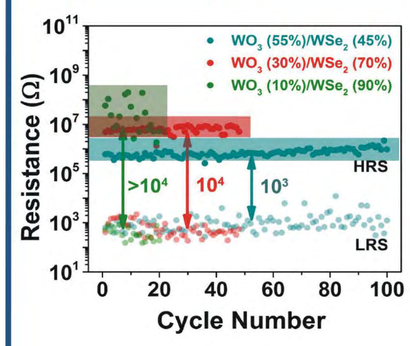
Results and Discussion

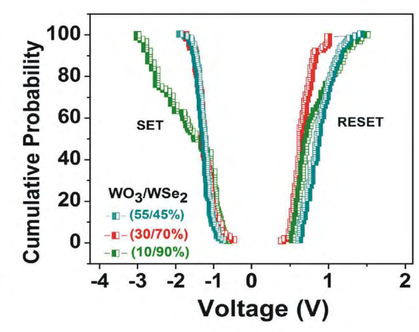
I-V characteristics

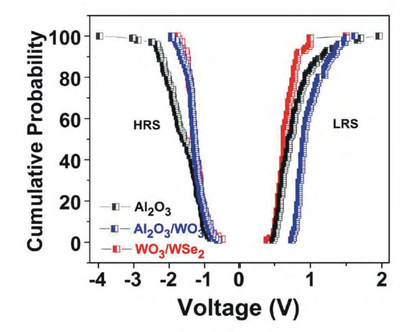




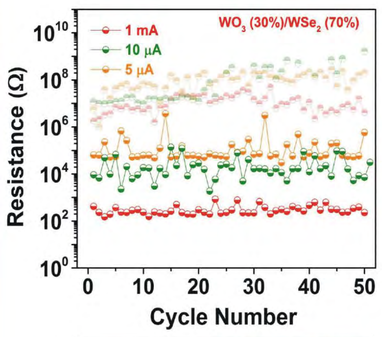


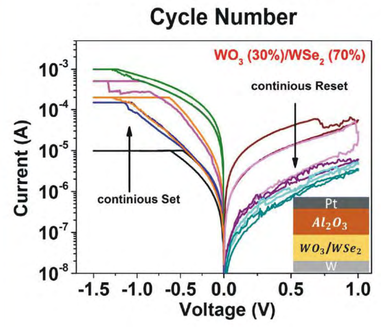


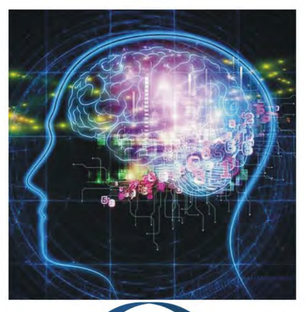




Multi-level and Neuromorphic Computing

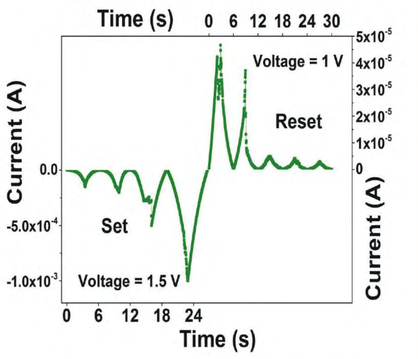


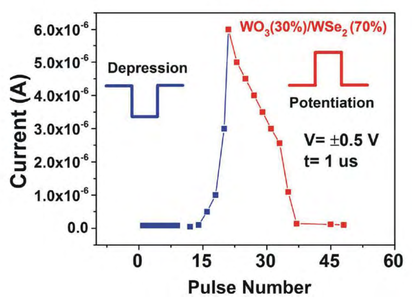




Parallel Processing

Neural Network





Conclusion

The paper demonstrates the Controlled formation of Conducting filaments via controlling the migration of Oxygen vacancy across the device.

References

1.Sun, Y.; Song, C.; Yin, J.; Chen, X. Z.; Wan, Q.; Zeng, F.; Pan, F. Guiding the Growth of a Conductive Filament by Nano indentation to Improve Resistive Switching. ACS Appl. Mater. Interfaces 2017, 9, 34064−34070.

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