# JNN Template

**Nanoarchitectonics for ............. (within 15 words)**

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## Abstract

Nanoarchitectonics is emerging concept .................... of polarity within bipolar resistive switching operation occurs in Pt/HfO2/TiN and Pt/Hf/HfO2/TiN resistive random access memory devices. This reversion of voltage polarity is the result of interface generation which induces a conduction mechanism transformation from Poole-Frenkel emission to space charge limited current mechanism. To prove the reversion of polarity, this study uses curve fitting of I-V relations to verify the conduction mechanism theoretically and physical analysis to verify the oxygen ion distribution practically. The proposed Pt/Hf/HfO2/TiN devices exhibit good resistive switching characteristics, such as good uniformity,low voltage operation, robust endurance (103 dc sweep), and long retention (3×104 s at 85 oC).

**Keywords:** HfO2, Resistive random access memory, Hf Metal Layer, polarity reversal.

**\*\*First Time Use of Abbreviations:** No abbreviations are allowed in the title and abstract, therefore, all abbreviations should be defined the first time they are used within the title and text. For example, use first time as; Fourier transform infrared (FTIR) spectroscopy, scanning electron microscopy (SEM), transmission electron microscope (TEM), X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), Visible/near-infrared (Vis/NIR) spectroscopy, X‐ray absorption fine structure (EXAFS) spectroscopy, etc.

## 1. Introduction

Nanoarchitectonics has been paid much attention as an emerging concept [1-5]. Resistive random access memory (RRAM) devices achieve the memory effect using the switchable resistance transformation between a high resistance state (HRS) and a low resistance state (LRS), and typically consist of a metal/insulator/metal structure. RRAM devices generally have two switching modes (unipolar and bipolar), which alternate based on the operating voltage polarity. Unipolar resistive switching occurs in any single voltage bias and does not depend on voltage polarity. Conversely, bipolar resistive switching depends on the variation of voltage polarity to complete the set (i.e., from the HRS to the LRS) and reset (i.e., from the LRS to the HRS) processes. Recent developments in RRAM have shifted to bipolar RRAM for several advantages, including a stable ON/OFF ratio, robust endurance, good retention, smaller switching voltage fluctuation, and the one selector-one resistor (1S1R) application [6]. The transition metal oxide, HfO2, is already widely used in semiconductor industries because of its superior physical properties, such as large permittivity, subsequent band gap, and excellent thermal stability [7]. In addition to its use as high-k/metal gate stacks, HfO2-based RRAM has attracted significant attention for its potential in next-generation nonvolatile memory. HfO2-based RRAM devices are formed by an electric-field induced conductive filaments formation/rupture process, and possess superior bipolar resistive switching for future RRAM applications.

The localized ........

## 2. Experimental Details

In this study, RRAM devices consist of

## 3. Results and Discussion

Figures 1a and 1b show

## 4. Conclusion

Figures 1a and 1b show

**Acknowledgments**

**References and Notes**

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"et al." or "ibid." in the reference list, instead, include names of all authors in a reference.

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## EXAMPLES

1. **Journal Articles**

[1] Komiyama, M.; Mori, T.; Ariga, K. **2018**. Molecular imprinting: materials nanoarchitectonics with molecular information. *Bulletin of the Chemical Society of Japan*, *91*(7), pp. 1075-1111.

[2] Azhar, A.; Li, Y.; Cai, Z.; Zakaria, M.B.; Masud, M.K.; Hossain, M.S.A.; Kim, J.; Zhang, W.; Na, J.; Yamauchi, Y.; Hu, M. **2019**. Nanoarchitectonics: a new materials horizon for Prussian blue and its analogues. *Bulletin of the Chemical Society of Japan*, *92*(4), pp. 875-904.

[3] Zhao, L.; Zou, Q.; Yan, X. **2019**. Self-assembling peptide-based nanoarchitectonics. *Bulletin of the Chemical Society of Japan*, *92*(1), pp. 70-79.

[4] Ariga, K.; Mori, T. ; Li, J. **2019**. Langmuir nanoarchitectonics from basic to frontier. *Langmuir*, *35*(10), pp. 3585-3599.

[5] Ariga, K.; Nishikawa, M.; Mori, T.; Takeya, J.; Shrestha, L.K.; Hill, J.P. **2019**. Self-assembly as a key player for materials nanoarchitectonics. *Science and Technology of Advanced Materials*, *20*(1), pp. 51-95.

## Book

Nalwa, H.S. and Miyata, S., eds., **1996.** *Nonlinear Optics of Organic Molecules and Polymers*. Boca Raton, CRC Press.

## Book Chapter

Krill, C.E., Harberkorn, R. and Birringer, R., **1999**. in *Handbook of Nanostructured Materials and Nanotechnology*, edited by H. S. Nalwa, Academic Press, Vol. 2, pp.155-211.

## Website

National Renewable Energy Laboratory (NREL) (https:[//ww](http://www.nrel.gov/solar%29)w.[nrel.gov/solar)](http://www.nrel.gov/solar%29)

## Conference Proceedings

Kimura, J. and Shibasaki, H., eds., **(1995)**. Recent Advances in Clinical Neurophysiology. *Proceedings of the 10th International Congress of EMG and Clinical Neurophysiology*, October 15-19; Kyoto, Japan. pp.10-15.

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*no charges* for color figures whatsoever so please make all figures in COLORS for a better presentation. It is very important to use **Large Fonts (size) for Numbering and Ligands** in all figures as shown below.



**Figure 1**. Reverse polarity operation in resistive switching between Pt/HfO2/TiN and Pt/Hf/HfO2/TiN devices.

# Graphical Abstract

The reversion of polarity within bipolar resistive switching operation occurs in Pt/HfO2/TiN and Pt/Hf/HfO2/TiN resistive random access memory devices. The proposed Pt/Hf/HfO2/TiN devices exhibit good resistive switching characteristics, such as good uniformity, low voltage operation, robust endurance (103 dc sweep), and long retention (3×104 s at 85 oC).

