https://doi.org/10.33263/Proceedings11.00450046

ISSN: 2668-6384 https://conferenceproceedings.international

Proceedings International

Proceedings, Abstract

Volume 1, Issue 1, Pages 0045-0046
2019

Received: 01.10.2019
Accepted: 10.10.2019
Published: 15.10.2019

Microstructural characterization of ferroelectric oxides thin films based on hafnia

C. Radu [1,*], C. M. Istrate [1], C. Ghica [1]

[1] National Institute of Materials Physics, 77125 Măgurele, Romania

* Correspondence: cristian.radu@infim.ro

Since the discovery of ferroelectricity in HfO_2 thin films, HfO_2 based materials have become of great interest for applications such as non-volatile random-access memory devices. Morphological and atomic scale structural investigations of nanomaterials are important in further understanding of their electrical properties. The electrical behavior (C-V, I-V characteristics and polarization hysteresis loop) of multilayer structures is greatly influenced by the quality of the deposited thin films and also the quality of the interfaces between the layers.

Transmission Electron Microscopy (TEM) is the most appropriate microstructural characterization technique able to provide morphological and structural information about the thin films and their interfaces. We study the morphological properties of this oxide based on hafnia because the orthorhombic phase exhibits ferroelectric properties.

In this work we use a Cs probe-corrected JEM ARM 200F electron microscope, TEM-SAED and HRTEM techniques to investigate the morphological structure of HfO_2 based thin films and to identify the crystalline phases of the ferroelectric oxide. The studied samples consist in thin films of HfO_2 deposited on a TiN electrode and the latter was deposited on a Si (100) substrate with a native SiO_2 layer.

The thin films were grown by atomic layer deposition (ALD) using TEMAHf and ZyALD precursors deposited at 300°C. HRTEM technique combined with FFT (Fast Fourier Transform) analysis provides a complete characterization of morphological and structural properties of the thin film.

Keywords: *ferroelectric oxides, TEM, atomic layer deposition.*

Funding

Not applicable.

Acknowledgments

Not applicable.

Conflicts of Interest

The authors declare no conflict of interest.

Cite This Work: Radu, C.; Istrate, C.M.; Ghica, C. Microstructural Characterization of Ferroelectric Oxides Thin Films Based on Hafnia. Proceedings Int **2019**, 1, 0045-0046.
https://doi.org/10.33263/Proceedings11.00450046

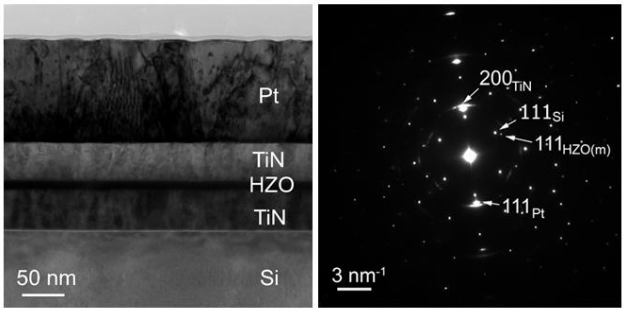

Figure 1. TEM image and corresponding SAED pattern of the Pt/TiN/HZO/TiN/Si heterostructure showing multiple crystalline phases.

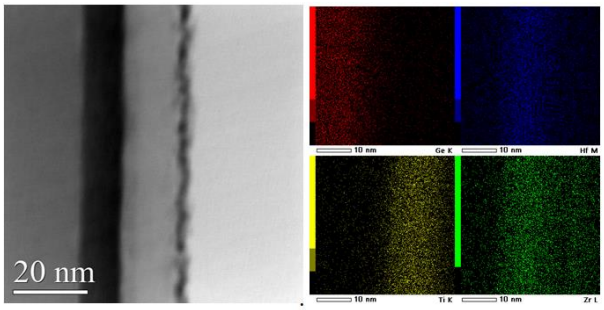

Figure 2. STEM image of TiN/HZO/Ge heterostructure and STEM- EDS map of Ti, Hf, Zr, Ge showing the elemental spatial distribution.

References

1. Hoffmann, M.; Fengler, F.P.G.; Herzig, M.; Mittmann, T.; Max, B.; Schroeder, U.; Negrea, R.; Pintilie, L.; Slesazeck, S.; Mikolajick, T. Unveiling the double-well energy landscape in a ferroelectric layer. *Nature* **2019**, *565*, 464–467, https://doi.org/10.1038/s41586-018-0854-z.

2. Everett, D.; Grimley, T.S.; Mikolajick, T.; Schroeder, Y.; LeBeau, J.M. Atomic Structure of Domain and Interphase Boundaries in Ferroelectric HfO2. *Advanced Materials Interfaces* **2018**, *5*, 1701258, https://doi.org/10.1002/admi.201701258.