

Investigation of the $\text{Hf}_{0.5}\text{Zr}_{0.5}\text{O}_2$ Phase Transformation with Field-assisted Thermal Treatment

Chia-Chieh Cheng (鄭佳杰)¹, Mau-Tsu Tang (湯茂竹)³, and Yuan-Chieh Tseng (曾院介)^{2*}

¹Program for Science and Technology of Accelerator Light Source, National Chiao Tung University, Hsinchu, Taiwan

²Department of Materials Science and Engineering, National Chiao Tung University, Hsinchu, Taiwan

³National Synchrotron Radiation Research Center, Hsinchu, Taiwan

yctseng21@mail.nctu.edu.tw

Abstract

Researches show that the ferroelectricity of HZO (50% Zr doped HfO_2 based ferroelectric material) thin-film has a strong relationship with the amount of non-centered symmetry orthorhombic phase (space group of Pca21 also known as ferroelectric phase). That is, the ratio of o-phase can greatly influence the ferroelectricity of HZO thin film. It is also reported that o-phase formed in the cooling step of the annealing process, the concentration of oxygen vacancies may influence the formation of o-phase. Therefore, in this study, we pulse the negative voltage during the cooling step to attract oxygen vacancies to make the phase change. As the phase configuration is altered, the ferroelectricity of HZO thin-film may also have a great impact. Polarization – voltage (P-V) measurement is one of the methods to detect ferroelectricity. By showing the remnant polarization change, we can easily determine the ferroelectricity of the HZO film. Based on synchrotron x-ray diffraction, we can further study the phase transformation mechanism about HZO. XRD results show that with the application of pulse voltage during the cooling step, the XRD pattern changed notably. In conclusion, a facile method has been introduced and shows notable improvement in ferroelectricity.

Keywords: *Ferroelectric film · Hafnium oxide · Oxygen vacancies*

References

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