# Evaluation of Scaling Zr-doped HfO2 Ferroelectric MOSCAPs

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## Abstract

For applications in memory, logic and neuromorphic devices, $HfO_2$-based materials as a gate dielectric in ferroelectric devices have attracted lots of attention and investigation due to good compatibility with CMOS and also potential application as advanced memory devices. For usual MFIS (metal ferroelectric insulator semiconductor) capacitor structure, a thin IL between ferroelectric layer and Si substrate modifies the quality of the interface. With the tendency of CMOS scaling, pursuing thinner EOT and higher density of devices accompanies some issues, including DC operating reliability, endurance performance and difficulty for maintaining high portion of orthorhombic phase during annealing. One of key factors influences the reliability is the thickness of the interfacial layer, which affects the gate leakage current, operating voltage, and those further affect the measurement of polarization and capacitance.

In this study, we fabricated 5-nm/2-nm $Hf_{0.5}Zr_{0.5}O_2$ (HZO) and $HfO_2$ ferroelectric MFIS capacitors with different thicknesses of IL via various immersing time in chemical solution to form $SiO_2$ for observation of the relationship between the thickness of the IL and ferroelectric characteristics. TEM was used to check the cross section of our devices, and in the part of ferroelectric analysis, polarization-voltage (*P*-*V*) and capacitance-voltage(*C*-*V*) help us to estimate the performance, based on comparison of remnant polarization (Pr) value and capacitance value in the accumulation region. Finally, for evaluating the influence on DC operation, gate leakage current was also characterized.