# Investigation of $HfO_2$ Dielectrics for Inter-Poly Dielectrics and Metal-Insulator-Metal Capacitors

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## Abstract

The inter-poly dielectrics (IPDs) and metal-insulator-metal (MIM) capacitors in next- generation nonvolatile memories (NVMs) and silicon RF applications have attracted great attention recently. The scaling down of IPDs is important with a large gate coupling coefficient, small cell size, and low programming voltage [1]. For MIM capacitors, which advantages are high conductive electrodes and low parasitic capacitance compare to IPDs [2]. Silicon oxide and silicon nitride are dielectrics that are commonly used in conventional capacitors, but their capacitance density are limited due to low dielectric constants. Among various high-k dielectric candidates, $HfO_2$ has been researched as a promising material in gate dielectric of MOSFETs due to its high dielectric constant, excellent thermal stability, and high band gap, etc. [3]. In addition, excellent MOS capacitors with $HfO_2$ have also been demonstrated [4].

In this work, we have investigated $HfO_2$ as dielectric of the IPDs and MIM capacitors. The thickness of $HfO_2$ deposited in MOCVD is 20nm. The 200nm-thick polysilicon is deposited in LPCVD. The metals used in MIM capacitors are sputtered TiN and HfN. Experimental results shows low leakage current of ~$10^9$ A and high dielectric constant of ~22 in MIM capacitors. The leakage current for IPDs is larger due to the roughness in polySi/HfO2 interface, and the dielectric constant is reduced because of the interfacial layer. The thermal stability of the IPDs and MIM capacitors is larger than 1000°C. Therefore, it is demonstrated that $HfO_2$ dielectric is very suitable in NVMs and silicon RF applications.

## References

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