Abstract Submitted
for the DAMOP10 Meeting of
The American Physical Society

Composition-Structural-Electrical Properties of Yttrium-Stabilized Hafnium Oxide Films Deposited by Atomic Layer Deposition
QIAN TAO, Department of Chemical Engineering, University of Illinois at Chicago, GREGORY JURSICH, Department of Mechanical and Industrial Engineering, University of Illinois at Chicago, CHRISTOS TAKOUDIS, Department of Chemical and Bioengineering, University of Illinois at Chicago — Sequential Atomic Layer Deposition was used to deposit yttrium-doped hafnium oxide films with variable yttrium content using tris (ethylcyclopentadienyl) yttrium, and tetrakis (diethylamino) hafnium as metal precursors and water vapor as the oxidizer. The structure and electrical properties of the resulting films were analyzed after different post-deposition annealing conditions to assess composition-structure-dielectric property relationships. 2.5–100% yttrium-doped films annealed above 600°C for 5 minutes consistently yielded cubic-HfO2 structures. However, there was a strong compositional effect on the dielectric constant, which maximized at ∼14% yttrium content. The films studied had leakage current density of 10^{-5} A/cm^2 or less at 1 V.

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Date submitted: 20 Jan 2010 Electronic form version 1.4