Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Atomic Layer Deposition of High-k Dielectrics Using Supercritical CO_2 RAJESH SHENDE, JORGE LUBGUBAN, MASLINA OTHMAN, SHUBHRA GANGOPADHYAY, Department of Electrical and Computer Engineering, University of Missouri - Columbia, Missouri 65211 — Atomic layer deposition (ALD) of high-κdielectric was performed in supercritical CO_2 ($SCCO_2$), using a two-step reaction sequence. In step one, tetraethoxy silane (TEOS) precursor was injected in $SCCO_2$ at 80-100 $^\circ$C and 50 MPa pressure to obtain a chemisorbed surface monolayer, which was then oxidized into SiO_2using peroxide entrained in $SCCO_2$. ALD process was controlled by estimating precursor solubility and its mass transport with respect to the density of $SCCO_{2,}$and correlating these parameters with precursor injection volume. In the ALD process, 7 pulses of precursor were used anticipating deposition of one atomic layer in each of the pulses. The thickness of the SiO_2 atomic layers deposited using $SCCO_2$ was measured by variable angle spectroscopic ellipsometry (VASE), and the $C - V$ measurements were also performed. The result obtained using VASE indicates that there were 7 monolayers of SiO_2 with total thickness of 35 $\AA$, and the dielectric constant of the deposited layers was 4.0±0.1. Our initial findings clearly demonstrate that $SCCO_2$ is capable of atomic layer deposition of high quality dielectric films at very low process temperatures preventing interface reaction. More research is in progress to achieve ALD of HfO_2 and TiO_2 in $SCCO_2$.

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Date submitted: 03 Dec 2004 Electronic form version 1.4