Abstract Submitted
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Nucleation, composition and morphology of ALD HfO_2 films JUSTIN C. HACKLEY, THEODOSIA GOUGOUSI, University of Maryland Baltimore County — A hot wall Atomic Layer Deposition flow reactor equipped with a Quartz Crystal Microbalance (QCM) has been used in the development of a HfO_2 process from tetrakis-ethylmethylamino hafnium (TEMAH) and H_2O precursors. We have studied the nucleation, composition and morphology of HfO_2 films deposited on H- terminated Si, native oxide and SC1 chemical oxide. Ellipsometry and QCM measurements confirm linear growth of the films ($\sim$1.2Å/cycle at 250 $^\circ$C). Similar incubation periods ($\sim$10 cycles) are found for depositions on the H-terminated Si and native oxide starting surfaces in agreement with recently published results.[1] AFM measurements show rms roughness of the as deposited films below 4% of the total film thickness. FTIR measurements show some OH and carbonate content in the films that are corroborated by XPS measurements. Rapid Thermal Anneal of the films in Ar (500 to 900 $^\circ$C, 2 min) results in the destabilization of the HfO_2/SiO_2 interface, increased rms roughness and crystallization of the film. FTIR and XPS analysis of the films annealed at 900 $^\circ$C in Ar confirm removal of the OH and carbonate species from the films. Finally, we present QCM measurements for the nucleation of HfO_2 films on Si and H-terminated surfaces.

[1]M.-T. Ho, Y. Wang, R. T. Brewer, L. S. Wielunski, Y. J. Chabal, N. Moumen, and M. Boleslawski, APL 87, 133103 2005

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