Abstract Submitted
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Structural evolution of nanoporous ultra-low k dielectrics under voltage stress[1] ARCHANA RAJA, Columbia University, THOMAS SHAW, ALFRED GRILL, IBM Yorktown Heights, ROBERT LAIBOWITZ, TONY HEINZ, Columbia University — High speed interconnects in advanced integrated circuits require ultra-low-k dielectrics. Reduction of the dielectric constant is achieved via incorporation of nanopores in structures containing silicon, carbon, oxygen and hydrogen (SiCOH). We study nanoporous SiCOH films of k=2.5 and thicknesses of 40 - 400 nm. Leakage currents develop in the films under long-term voltage stress, eventually leading to breakdown and chip failure. Previous work* has shown the build-up of trap states as dielectric breakdown progresses. Using FTIR spectroscopy we have tracked the reorganization of the bonds in the SiCOH networks induced by voltage stress. Our results indicate that the cleavage of the Si-C and SiC-O bonds contribute toward increase in the density of bulk trapping states as breakdown is approached. AC conductance and capacitance measurements have also been carried out to describe interfacial and bulk traps and mechanisms. Comparison of breakdown properties of films with differing carbon content will also be presented to further delineate the role of carbon. *Atkin, J.M.; Shaw, T.M.; Liniger, E.; Laibowitz, R.B.; Heinz, T.F. Reliability Physics Symposium (IRPS), 2012 IEEE International

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