Reliability Projection and Polarity Dependence of TDDB for Ultra Thin CVD HfO_2 Gate Dielectrics

S. J. Lee, S. J. Rhee, R. Clark, Roberts*, and D. L. Kwong

Microelectronics Research Center, Department of Electrical and Computer Engineering, The University of Texas, Austin, TX 78712, (512)471-5749, Fax: (512)471-5625, sungjoo@mail.utexas.edu
*** Schumacher, Calsbad, CA 92009**

Abstract

A systematic study of long-term reliability of ultra thin CVD HfO_2 gate stack (EOT=10.5Å) with TaN gate electrode is presented. The polarity and area dependence and temperature acceleration of time-to-breakdown (T_{BD}), defect generation rate, and critical defect density are studied. It is found that T_{BD} is polarity-independent ($T_{BD,-Vg}$=$T_{BD,+Vg}$). After temperature acceleration of 150°C, area scaling to 0.1cm^2, and the projection to low percentage failure rate of 0.01%, the maximum operating voltages are projected to be Vg= 0.6V for EOT = 8.6Å and Vg= 0.75V for EOT = 10.6Å.