"NBTI: Why Won't This Thing Go Away?"

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Introduction to the topic:
The negative-bias temperature instability (NBTI) is a reliability problem that, in the last ten years, has risen from relative obscurity to become the most important reliability problem in advanced pMOSFET devices. Even though a significant effort has been spent trying to eliminate NBTI signatures (negative threshold voltage shift and transconductance degradation after inversion gate stress at elevated temperatures), the issue still persists. NBTI's elusiveness is due, at least in part, to the fact that NBTI-induced degradation relaxes very quickly after the conclusion of stress. This makes NBTI characterizations quite tedious and clouds the fundamental understanding of the degradation/relaxation mechanism.

Structure of tutorial:
This tutorial summarizes the noteworthy NBTI experimental observations/techniques and discusses how these observations might be leading towards a fundamental understanding of NBTI. A general aim is to examine how these observations validate/invalidate the current understanding of NBTI. The general outline of the tutorial is as follows:

(1) NBTI basics (universal observations, common measurement techniques, etc…)
(2) Relaxation
(3) A brief overview of theoretical attempts (models)
(4) Fundamental magnetic resonance observations
(5) Do these observations fit the current picture of NBTI?
(6) Remaining controversies: fundamental questions still unsolved

Who should attend:
This tutorial presents a general overview of NBTI which should be suitable for anyone interested in front-end reliability. The goal is to critically examine the fundamental physical picture of NBTI with limited assumptions.

Biography of tutorial speaker:
Jason P. Campbell received his B.S. and Ph.D. in Engineering Science from Penn State University, University Park, PA in 2001 and 2007, respectively. In 2007, he was awarded a National Research Council (NRC) post-doctoral fellowship which he spent in the Semiconductor Electronics Division at the National Institute of Standards and Technology (NIST) where he is currently still employed. He has contributed to more than 35 refereed papers and conference presentations at national and international conferences and has been involved in the technical and managerial committees of both the IIRW and IRPS conferences. His research interests involve the fundamentals of NBTI, random telegraph noise in highly scaled devices, and alternative magnetic resonance measurements.