Abstract

The Negative bias temperature instability (NBTI) is one of the most important reliability issues for modern CMOS technology. Accurate reliability prediction necessitates physically based models for NBTI and accurate methods for estimation of interface (ΔN_{it}) and oxide trap (ΔN_{ot}) generated under this degradation as well as mobility degradation ($\Delta\mu_{eff}/\mu_{eff0}$). In this paper, we propose an accurate approach to estimate ΔN_{it}, ΔN_{ot} and $\Delta\mu_{eff}/\mu_{eff0}$ induced by NBTI degradation. This approach is based on combining on-the-fly interface trap (OTFIT) and on-the-fly threshold voltage (OTF-V_{th}) methods in the same time measurement setup, contrary to the classical combination where the two methods (OTFIT and OTF-V_{th}) are applied separately in two different measurements setups and using two transistors. In addition, the contribution of border trap to the charge pumping (CP) current in OTFIT is minimized using the high frequency signal and the scan band energy of the two combined methods is calibrated. Therefore, the data set of OTFIT and OTF-V_{th} can be directly comparable. The proposed approach can contribute to further understand the behavior of the NBTI degradation, especially through the mobility degradation and the threshold voltage shift contributions of interface (ΔV_{it}) and oxide traps (ΔV_{ot})