## Abstract

In the present paper, we propose a new and physically based model for the negative bias temperature instability. The proposed model can predict the most accepted features of the degradation such as fast degradation recovery, as well as the long term recovery component. The field of negative bias temperature instability is filled with models proposed by many research groups. Most reliable models converge around the fact that the degradation is originated from two components; one of them is rapidly created and annealed whereas the other is permanent. However, these reliable models diverge on the microscopic nature of the two components and on the relation between them, especially whether they are correlated or not. Hydrogen, E center, and Pb center are the most cited oxide defects to be the microscopic origin of the degradation. The fact that reliable and accurate studies end in contradicting results leads us to think that the origin of negative bias temperature instability degradation is the same thing seen from different angles. In this spirit, our model reconciles the two widely and experimentally proved features, which are hydrogen diffusion in the oxide, on one hand, and hole trapping and detrapping by oxide defects, on the other hand. This model predicts that both hydrogen and hole trapping/detrapping in the oxide defects play a key role in negative bias temperature degradation. The fast component is ascribed to hole trapping and detrapping in the oxide E' centers and interface dangling bonds generation. The permanent component is attributed to the E' – H complex and limited by the back diffusion of the hydrogen in the oxide to passivate Pb centers. One of the particularities of the proposed model is that the two components are both dependent (correlated) and independent (uncorrelated). During the stress period, the components are tightly coupled whereas during the long-term recovery the components are decoupled.