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Role of iron impurity complexes in degradation of GaN/AlGaN HEMTs[1] YEVGENIY PUZYREV, Vanderbilt University, SOKRATES PANTELIDES, Vanderbilt University, Oak Ridge National Laboratory, VANDERBILT UNIVERSITY TEAM — GaN/AlGaN high electron mobility transistors (HEMTs) are leading candidates for power RF devices, but they suffer from reliability issues, in particular, a current collapse. Experiments have shown that the current collapse is correlated with the presence of a Tp1 trap in either the GaN substrate or at the surface with an energy level at about 0.55 eV below the GaN conduction band. Recent experiments demonstrated that the E_c-0.55eV level increases with the decrease of the distance from the channel to the *Fe*-doped GaN. Another study found a correlation between threading dislocation density (TDD) and the concentration of E_c-0.55eV trap. Drastic decrease of E_c-0.55eV trap concentration is observed after hydrogenation of the samples. During OFF state stress, the population of the generated Tp1 trap is proportional to the square root of the stress time, suggesting Tp1 generation is correlated to the diffusion of a point defect. We present results of first-principle calculations and show that degradation occurs by the dehydrogenation of Fe and Fe-vacancy complexes. Using these results we analyze available experimental data and provide a comprehensive picture of the generation of the E_c-0.55eV trap level.

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Yevgeniy Puzyrev
Vanderbilt University

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