Thermal electron capture rate by Fe acceptor in GaN. J. Dashdorj, M.E. Zvanut, University of Alabama at Birmingham, T. Paskova, K. Udwary, Kyma Technologies, Inc. — Doping GaN with Fe compensates the main residual impurities such as O and Si to produce semi-insulating substrates. Electron paramagnetic resonance measurements were made on GaN grown by hydride vapor phase epitaxy and doped with $1.5 \times 10^{17}$ to $1.6 \times 10^{18}$ cm$^{-3}$ Fe. The Fe$^{3+}$ spectra, angular dependence, and concentrations are consistent with literature and secondary ion mass spectroscopy data. During illumination with photon energies greater than 1.2 eV, the Fe$^{3+}$ signal increased in the lowest doped sample, but decreased in the more highly doped samples. One possible interpretation of the results is that the Fe$^{2+}/3+$ and Fe$^{3+}/4+$ levels are about 1.2 eV below the conduction band. Due to our measurement resolution, the spectral separation between the levels cannot be determined. The time-dependence of the Fe$^{3+}$ signal recovery after removal of 2.64 eV was recorded at temperatures between 3.5 and 297 K. Analysis show that capture rate of electrons by Fe$^{3+}$ decreases from $6 \times 10^{-16}$ to $5 \times 10^{-17}$ cm$^3$/s with an inverse-square-root temperature dependence. The work is supported by the NSF.

J. Dashdorj
University of Alabama at Birmingham

Date submitted: 08 Dec 2010  Electronic form version 1.4