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Hydrogen incorporation in high hole density GaN:Mg

M.E. ZVANUT, Y. UPRETY, J. DASHDORJ, University of Alabama at Birmingham, M. MOSELEY, W. ALAN DOOLITTLE, Georgia Institute of Technology — We investigate hydrogen passivation in heavily doped p-type GaN using electron paramagnetic resonance (EPR) spectroscopy. Samples include both conventionally grown GaN (10^{19} \text{ cm}^{-3} \text{ Mg}, 10^{17} \text{ cm}^{-3} \text{ holes}) and films grown by metal modulation epitaxy (MME), which yielded higher Mg (1-4x10^{20} \text{ cm}^{-3}) and hole (1-40x10^{18} \text{ cm}^{-3}) densities than found in conventionally grown GaN. The Mg acceptor signal is monitored throughout 30 minute annealing steps in N_2:H_2 (92\%:7\%) and subsequently pure N_2. N_2:H_2 heat treatments of the lower hole density films begin to reduce the Mg EPR intensity at 750 °C, but quench the signal in high hole density films at 600 °C. Revival of the signal by subsequent N_2 annealing occurs at 800 °C for the low hole density material and 600 °C in MME GaN. The present work highlights chemical differences between heavily Mg doped and lower doped films; however, it is unclear whether the difference is due to changes in hydrogen-Mg complex formation or hydrogen diffusion.

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