The origin of the high hole density in In$_x$Ga$_{1-x}$N:Mg. WILLIAM WILLOUGHBY, MARY ELLEN ZVANUT, University of Alabama at Birmingham — InGaN is the nitride of choice for applications requiring high hole density and emission tunability. The increased hole density with In incorporation may be explained by several different mechanisms; however, our electron paramagnetic resonance (EPR) studies reveal a surprising feature: the number of Mg-related acceptors decreases with increasing hole density. In$_x$Ga$_{1-x}$N films, with $x$ between 0.02 and 0.11 and thickness between 0.25 and 0.44 μm, were grown p-type by doping with Mg to a concentration of $2-3 \times 10^{19}$ cm$^{-3}$. Hall measurements reveal the expected hole density increase from 5-30$\times$10$^{17}$ cm$^{-3}$ with increasing In mole fraction. However, unlike GaN:Mg where the EPR Mg signal tracks the hole density, the EPR intensity of the Mg-related signal in InGaN is found to decrease as the hole density increases. Together, compensating defects and a lowering of the acceptor level may explain the decrease in EPR intensity and the increase in hole density observed as the In mole fraction is increased.

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