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The source of holes in p-type $In_xGa_{1-x}N$ films[1] MARY ELLEN ZVANUT, WILLIAM WILLOUGHBY, University of Alabama at Birmingham — InGaN is an important alloy for many optoelectronic applications due to its tunable bandgap, which can range from ~1-3 eV, corresponding to wavelengths of ~400-1200 nm. $In_xGa_{1-x}N$ films, with x between 0.02 and 0.11, are studied at 4 K using electron paramagnetic resonance (EPR) spectroscopy. The films were made p-type by doping with Mg to a concentration of 2-3$\times10^{19}$ cm^{-3}, and the thickness of each film was between 0.25 and 0.44 μm. Hall measurements show that the hole density of a film increases with increasing In mole fraction, as expected, but the measured EPR intensity of the Mg-related signal is found to decrease. This trend is opposite of what is observed in other nitrides. Because the Mg-related EPR signal intensity represents the amount of unionized Mg, the amount of EPR detected Mg at low temperatures (~4K) tracks the hole concentration at room temperature in p-type GaN films. 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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