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Photoluminescence studies of impurity transitions involving nitrogen vacancies in Mg-doped AlGaN alloys M. L. NAKARMI, N. NEPAL, J. Y. LIN, H. X. JIANG, Kansas State University — Although tremendous progress has been made in the development of AlGaN alloys and their applications in deep UV devices, achieving p-type conductivity in Al-rich AlGaN alloys is still highly challenging because of the large activation energy of the magnesium (Mg) acceptors and strong compensation effects due to the presence of intrinsic defects. We report on the growth by metalorganic chemical vapor deposition and photoluminescence studies of Mg-doped $Al_xGa_{1-x}N$ alloys. A group of deep level impurity transitions was observed in Mg-doped $Al_xGa_{1-x}N$ alloys which was identified to have the same origin as the previously reported blue line at 2.8 eV in Mg-doped GaN and was assigned to the recombination of electrons bound to the nitrogen vacancy with three positive charges (V_N^{3+}) and neutral Mg acceptors. Based on the measured activation energies of the Mg acceptors in AlGaN and the observed impurity emission peaks, the V_N^{3+} energy levels in $Al_xGa_{1-x}N$ have been deduced for the entire alloy range. The presence of high density of V_N^{3+} deep donors translates to the reduced p-type conductivity in AlGaN alloys due to their ability for capturing free holes. With the identification of the emission peaks associated with V_N^{3+} hole compensating centers, we were able to improve the p-type conductivity of Al-rich AlGaN by monitoring and suppressing the intensity of the V_N^{3+} related emissions.

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