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Effects of N incorporation on the electronic structure of GaNP: Origin of the 2.87 eV optical transition IRINA BUYANOVA, M. IZADIFARD, WEIMIN M. CHEN, Department of Physics and Measurement Technology, Linkoping University, Sweden, H.P. XIN, C.W. TU, Department of Electrical and Computer Engineering, University of California, San Diego, USA, S.J. PEARTON, Department of Materials Science and Engineering, University of Florida, Gainesville, USA
— Temperature dependent photoluminescence excitation (PLE) spectroscopy is employed to evaluate basic physical properties of the 2.87 eV absorption peak, recently discovered (I. A. Buyanova et al, PRB 69, 201303 (2004)) in the GaN_xP_{1-x} alloys. Whereas appearance of this transition is found to be facilitated by incorporation of N and also H atoms, its intensity does not scale with N content. This questions a possible association of this feature with a N-related localized state. Based on the results of temperature dependent measurements, the involved state is concluded to have a non-Γ character. Excitation of the known N-related localized states via this state is found to be non-selective, opposed to that between the N-related centers. The observed properties are shown to be hardly consistent with those predicted for the higher lying localized state of the isolated N atom derived from the Γ conduction band minimum (CBM). Alternative explanations for the "2.87 eV" state as being due to either a t_2 component of the X_3^c (or L_1^c) CBM or a level arising from a complex of N and H (in some form) are also discussed.

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