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Planar modulation of the conduction band edge in GaNxAs1-x
KIRSTIN ALBERI, O.D. DUBON, Dept. Materials Science, Univ. of California and Lawrence Berkeley National Laboratory, Berkeley, CA 94720, A. MINOR, W. SHAN, K.M. YU, W. WALUKIEWICZ, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, S.J. CHUNG, Univ. of California, Berkeley, CA 94720, D.E. MARS, Agilent Laboratories, Palo Alto, CA 94304, F. ZAVALICHE, Dept. of Materials Science, Univ. of California, Berkeley, Ca 94720 and M.R.S.E.C., Univ. of Maryland, College Park, MD 20742 — A novel approach for inducing a planar modulation of the conduction band for the fabrication of quantum structures within a GaN_xAs_{1-x} thin film is presented. This dilute nitride alloy exhibits a giant bandgap bowing as a result of the downward shift of the conduction band edge upon the incorporation of N into GaAs. We demonstrate that amorphization of a GaN_xAs_{1-x} film followed by rapid thermal annealing results in the realease of N from the As sublattice and the formation of eptiaxial, single-crystalline GaAs. Selective amorphization of GaN_xAs_{1-x} has been achieved by Ga ion implantation using a focused ion beam (FIB). For typical FIB implantation conditions, an amorphous region approximately 20 nm deep and 50 nm wide is produced. Upon annealing the pattern of amorphized film regrows, yielding co-existing regions of GaAs and (unimplanted) GaN_xAs_{1-x} across the surface. Thus, dot and wire structures are fabricated through appropriate FIB implantation pattern design.

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