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Dilute GaAs-Nitride Alloys Grown with Bismuth by MBE D. A. BEATON, T. TIEDJE, S. TIXIER, S. E. WEBSTER, N. R. ZANGENBERG, Physics and Astronomy, E. C. YOUNG, Materials Engineering, University of British Columbia, Vancouver, BC, P. WEI, F. SCHIETTEKATTE, Departement de Physique, Universite de Montreal , Montreal, PQ, S. FRANCOEUR, National Renewable Energy Lab, Golden, CO — Under conventional MBE growth conditions for the dilute nitride GaN_xAs_{1-x}, a Bi flux sufficient to saturate the growth surface yields negligible Bi incorporation due to its strong tendency to surface segregate. However the Bi increases the N incorporation efficiency by up to 50% and improves the electronic quality of the material by reducing the density of gap states as measured by variable temperature photoluminescence. Under conditions of low As overpressure and low growth temperature (∼370C) Bi can be incorporated into GaAs either by itself or in combination with N. Similar to the dilute nitride, the dilute bismide exhibits strong concentration dependent reductions in the bandgap. We observe strong room temperature photoluminescence at 1150 nm in a dilute quaternary $GaN_xAs_{1-x-y}Bi_y$ alloy lattice matched to GaAs. The quaternary alloy shows a bandgap reduction that is equal to or larger than the reduction due to the sum of the effects of Bi and N individually, in contrast to GaInNAs where the combined effect of In and N is less than the sum of the effects of In and N individually.

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