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Directed Matrix Seeding of Nitride Semiconductor Nanocrystals
A.W. WOOD, B.L. CARDOZO, W. YE, X. WENG, R.S. GOLDMAN, Materials Science and Engineering, Univ. of Michigan, Y.Q. WANG, Materials Science and Tech. Division, LANL — The controlled formation of semiconductor nanocomposites offers a unique opportunity to tailor functional materials with a variety of novel properties. A promising approach to nanocomposite synthesis is matrix-seeded growth, which involves ion-beam-amorphization of a semiconductor film, followed by nanoscale re-crystallization via annealing. In this work, we are studying the formation and evolution of N ion-implanted InAs and GaAs (InAs:N, GaAs:N). The InAs:N and GaAs:N nanocomposites are synthesized using 100keV ion-implantation with a dose of $5x10^{17}cm^{-2}$, at 77K and 300C, respectively. In all cases, the as-implanted structures are primarily amorphous, and after appropriate rapid thermal annealing (RTA) sequences, zincblende (ZB) InN and GaN [1] nanocrystals are formed. We are also developing a novel approach to *direct* the seeding of nanostructure arrays, using a combination of focused-ion-beam (FIB) implantation in combination with conventional ion implantation. To date, we have demonstrated the selective positioning of wurtzite (WZ) and ZB GaN nanocrystals using 75keV and 100keV N implantation, followed by FIB patterning and 800C RTA. The growth mechanisms and structural evolution of nitride crystallites will also be discussed. [1] X. Weng, et al, *J. Appl. Phys.*, **92** 4012 (2002)

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