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Origins of Persistent Photoconductivity in GaAsN Alloys R.L. FIELD III, Department of Physics, University of Michigan, Y.Q. WANG, Materials Science and Technology Division, Los Alamos National Laboratory, C. KURDAK, Department of Physics, University of Michigan, R.S. GOLDMAN, Department of Materials Science and Engineering, University of Michigan — In $GaAs_{1-x}N_x$ alloys, we observe significant persistent photoconductivity (PPC) at cryogenic temperatures for $x > 0.006$, with the PPC strength increasing with increasing x and decreasing upon rapid-thermal annealing (RTA). Since the RTA-induced suppression is accompanied by a reduction of the interstitial N fraction, the N-induced donor state is likely associated with N pairs. PPC is attributed to the promotion of carriers from a ground N-pair state to the conduction band edge, inducing modifications in the N-pair molecular bond configuration. When illumination is terminated, an energy barrier hinders the return of carriers to the N-pair induced complex. With the addition of thermal energy, the original N-pair configuration is restored and the N-pair induced complex is then able to accept carriers. We use PPC at cryogenic temperatures to go through a metal-insulator transition in GaAsN by increasing the carrier density with illumination. For different illumination durations we determine the minimum metallic conductivity, giving us the critical carrier density, n_c, at the transition point. We then determine the effective mass, $m*$, using the Mott criterion $n_c^{1/3} a_H = 0.26$ where $a_H = (4\pi\varepsilon \mathrm{h}^2)/(e^2 m^*)$ is the Bohr radius. We use PPC to induce a metal-insulator transition in GaAsN. We will discuss the effective mass as a function of N concentration and compare to the predictions of the band anticrossing model.

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