Origin of Persistent Photoconductivity Effect in GaAsN Alloys

YU JIN, HAILING CHENG, RYAN JOCK, CAGLIYAN KURDAK, RACHEL GOLDMAN, University of Michigan — (In)GaAsN alloys with a few percent nitrogen have potential applications in many long wavelength optoelectronic devices. However, the formation of point defects, such as N interstitials and Si-N complexes, has been predicted to substantially limit the optical emission efficiency and minority carrier transport of (In)GaAsN. Here, we report a persistent photoconductivity (PPC) effect associated with N interstitial-related defects in GaAsN films. In our GaAsN films, PPC was observed up to 160K, with a photo-capture barrier of 350 - 400 meV. Meanwhile, low T transport measurements reveal two regimes of carrier concentration, \( n \), a \( T \)-independent regime above 150K and a thermally-activated regime below 150K. These two phenomena are reminiscent of the behavior of n-type AlGaAs due to the presence of DX-center levels, suggesting the presence of similar N-induced defect levels in GaAsN. Furthermore, after annealing, the PPC effect is suppressed and \( n \) increases substantially. Our recent nuclear reaction analysis revealed that the interstitial N concentration is decreased by RTA. Therefore, the RTA-induced suppression of the PPC and the increase of \( n \) in GaAsN suggest their association with N interstitials.

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