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Electrical activation studies of $Al_{0.4}Ga_{0.6}N$ and $Al_{0.5}Ga_{0.5}N$ implanted with silicon for n-type doping. ELIZABETH MOORE, YUNG KEE YEO, Air Force Institute of Technology, MEE-YI RYU, Kangwon National University, ROBERT HENGEHOLD, Air Force Institute of Technology — A systematic electrical activation study of Si-implanted $Al_xGa_{1-x}N$ with Al concentrations of 40 and 50% grown on sapphire substrates by MEMOCVD has been made as a function of ion dose and anneal temperature. The silicon ions were implanted at 200 keV with doses from 1x10^{14} to 1x10^{15} cm^{-2} at room temperature. The samples were proximity cap annealed from 1150 to 1350 ^oC for 20 minutes in a nitrogen environment. Hall-effect measurements were made from 10 to 700 K and cathodoluminescence measurements were taken at 7 K. Electrical activations of nearly 100% were obtained for the $Al_{0.4}Ga_{0.6}N$:Si after annealing at 1350 $^\circ$C for 20 minutes for doses of 1x10^{14} and 5x10^{14} cm^{-2} and after annealing at 1200 $^\circ$C for 20 minutes for the dose of 1x10^{15} cm^{-2}. The $Al_{0.5}Ga_{0.5}N$:Si also had high activations of nearly 100% for the two lower doses after annealing at 1300 $^\circ$C for 20 minutes, while for a dose of 1x10^{15} cm^{-2}, an activation of 66% was obtained after the same annealing treatment. The highest room temperature mobility for the $Al_{0.4}Ga_{0.6}N$ and $Al_{0.5}Ga_{0.5}N$ samples are 61 and 55 $cm^2/V{\cdot}s$, respectively for the samples annealed at 1350 $^\circ$C for 20 minutes. CL spectra support the electrical results in determining the optimal annealing conditions.

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