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Electrical properties of Si-implanted Al$_x$Ga$_{1-x}$N with high Al mole fraction ELIZABETH MOORE, Air Force Institute of Technology, MEE-YI RYU, Kangwon National University, YUNG KEE YEO, ROBERT HENGE-HOLD, Air Force Institute of Technology — Ion implanted AlGaN has not been well investigated, in particular AlGaN with high Al mole fraction, compared to the research of ion-implanted GaN. Therefore, a systematic electrical activation study of Si-implanted AlGaN with Al mole fraction from 0.1 to 0.5 has been made as a function of ion dose and anneal temperature. The AlGaN wafers were grown on sapphire substrates by migration enhanced metal organic vapor deposition. Silicon ions were implanted at 200 keV with doses from $1 \times 10^{14}$ to $1 \times 10^{15}$ cm$^{-2}$ at room temperature. The samples were proximity cap annealed from 1100 to 1350 °C with a 500 Å AlN cap in a nitrogen environment. The results of Hall Effect measurements show that electrical activation efficiencies of 77% and 53% were obtained respectively for the Al$_{0.4}$Ga$_{0.6}$N and Al$_{0.5}$Ga$_{0.5}$N implanted with a dose of $1 \times 10^{15}$ cm$^{-2}$ and annealed at 1350 for 20 min. The Al$_{0.1}$Ga$_{0.9}$N samples exhibited a mobility of 100 cm$^2$/V•s, while the Al$_{0.5}$Ga$_{0.5}$N showed a mobility of half that value. It has been found that the samples with higher Al mole fraction generally require a higher anneal temperature and/or longer anneal time for a better electrical activation. Also, the mobility of the sample was found to decrease as the Al mole fraction increases.

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