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Magnetic and structural properties of Fe-implanted cubic GaN

Journal of Applied Physics **120**, 103901 (2016); <https://doi.org/10.1063/1.4962275>V. A. N. Righetti¹, X. Gratens¹, V. A. Chitta¹,  [M. P. F. de Godoy](#)²,  A. D. Rodrigues², E. Abramof³, J. F. Dias⁴, D. Schikora⁵, D. J. As⁵, and K. Lischka⁵[View Affiliations](#)[View Contributors](#)[Topics ▾](#) PDF

In this article, we report on structural and magnetic properties of cubic GaN epitaxial layers implanted with Fe ions and subsequently subjected to thermal annealing. The epitaxial quality of the layers was studied by X-ray diffraction rocking curves (ω -scans) and Raman spectroscopy. The results show that the implantation damages the crystal structure producing an expansion of the lattice parameter in the implanted region. These damages are partially removed by the thermal treatment. Room temperature ferromagnetism is observed for the sample implanted with a dose of $1.2 \times 10^{16} \text{ cm}^{-2}$, while samples implanted with $2.4 \times 10^{16} \text{ cm}^{-2}$ show a coexistence of ferromagnetism and paramagnetism due to disperse Fe^{3+} . Thermal annealing changes these magnetic properties. For the low dose sample, the ferromagnetism is converted into paramagnetism while for the high dose we observed an enhancement of the ferromagnetic contribution characterized by a superparamagnetism behavior attributed to Fe-based particles.

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