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ABSTRACTS

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PSTh-I-321 DILUTED MAGNETIC SEMICONDUCTOR OF Co ION-IMPLANTED GaN.

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GaN is a very promising host material for making dilute magnetic semiconductor (DMS).[1] We have investigated the characteristics for magnetic semiconductor of Co ion-implanted GaN by using high resolution x-ray diffraction (HRXRD), superconducting quantum interference device (SQUID) magnetometer, x-ray photoelectron spectroscopy (XPS), and photoluminescence (PL). 2-μm thick GaN epilayer was prepared, and 80 KeV Co^- ions with a dose of 3×10^{16} cm^{-2} were implanted into GaN at 350 ℃. The implanted samples were post annealed at 700-900 ℃ by rapid thermal annealing (RTA) in N_2 atmosphere for 5 min to recrystallize the samples. XRD results did not show any peaks associated with second phase formation and only the diffraction from the GaN layer and substrate structure were observed. The magnetization curve at 5 K show clear ferromagnetic behavior for 700-900 ℃ annealed-samples. In zero field-cooled (ZFC) and field-cooled (FC) magnetization measurements, the irreversibility and a cusp-like behavior of the ZFC curve were observed. These two features indicate the occurrence of superparamagnetism in films. XPS depth measurements show the metallic Co 2*p* core levels and the metallic valence band spectra for 700-900 ℃ annealed-samples. From these, it is considered that magnetic property of our films originated from Co or CoGa magnetic clusters. In the PL spectra obtained at 10 K, noticeable changes are observed in the spectra between unimplanted and as-implanted with post-annaneled samples. The spectra display a clear intensity modulation, indicating that the microcavity effect occurs in the layers.

[1] Kazunori SATO and Hiroshi KATAYAMA-YOSHIDA, Jpn. J. Appl. Phys. **40**, L485 (2001).