$GaIn_{0.36}N_{0.006}AsSb_{0.015}/GaN_{0.01}AsSb_{0.11}/GaAs$ 量子井戸のスピン緩和

Spin relaxation in $GaIn_{0.36}N_{0.006}AsSb_{0.015}/GaN_{0.01}AsSb_{0.11}/GaAs$ quantum well

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Diluted nitride GaInNAs/GaAs quantum well(QW) structures are expected to be the light source for a long wavelength range diode laser.[1] The use of Sb was found to help maintain a 2D growth mode at high In and N compositions and to improve the QW optical properties.[2,3] By adding GaNAsSb intermediate barriers, 1.61 μm emissions from a GaInNAsSb QW was achieved at room temperature.[4] In this study, we report the temperature dependence of the spin relaxation time in GaInNAsSb/GaNAsSb/GaAs QW observed by time-resolved pump and probe reflectance measurements.[5]

The sample consists of 8 nm-thick $GaIn_{0.36}N_{0.006}AsSb_{0.015}$ well sandwiched by 5 nm-thick $GaN_{0.01}AsSb_{0.11}$ intermediate barriers and 100-nm-thick GaAs barriers grown by molecular beam epitaxy on a GaAs(100) substrate. In the pump and probe measurements, laser energy was tuned near the wavelength of the photoluminescence peak. A Ti:sapphire laser with an optical parametric oscillator was used as the optical source. The time resolution of this measurement system is 200 fs.

Figure 1 shows the time evolutions of the reflection intensity of cocircular (I^+) and anticircular (I^-) polarization at 10 K for the excitation power of 15 mW. The inset shows the time evolution of spin polarization. We observed the double exponential decay with time constants of 12.4 ps and 106 ps.

Figure 2 shows the temperature dependence of the spin relaxation time. The spin relaxation time was found to be insensitive to temperature between 10 K and 50 K. At temperatures over 50 K, we have observed the strong temperature dependence showing that the spin relaxation is mainly governed by D'yakonov-Perel process[6] or Eliott-Yafet process.[7]

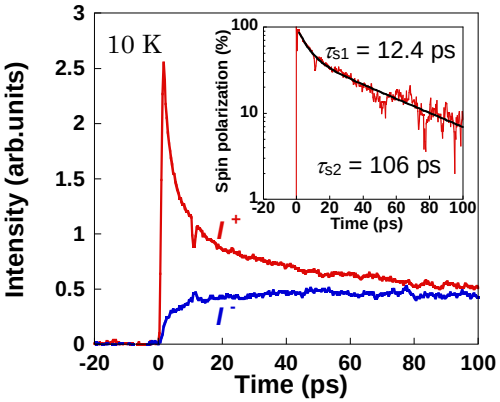

Fig. 1. Time evolution of the reflection intensity and spin polarization (inset) at 10 K for the excitation power of 15 mW.

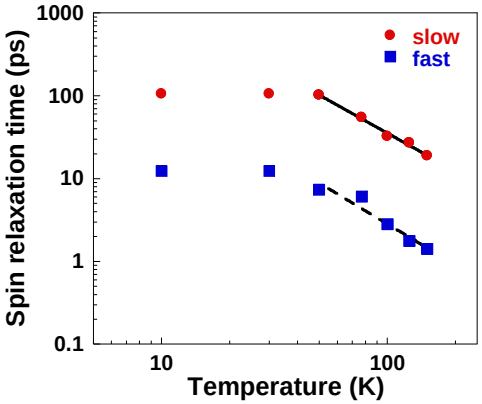

Fig. 2 Temperature dependence of the spin relaxation time for the GaInNAsSb/GaNAsSb/GaAs QW.

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