The effect of localized electric field in the type-II InAs/GaAsSb quantum dot using photoreflectance spectroscopy

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We investigated the effect of localized electric field in the type-II InAs/GaAsSb quantum dot (QD) in GaAs matrix by photoreflectance (PR) spectroscopy. Excitation laser intensity dependent-PR experiment was performed at 10 K to enhance confinement effect of carriers which are spatially separated into electrons in InAs and holes in GaAsSb due to the type-II band alignment. In addition, the PR results of InAs/GaAsSb type-II system were compared with those of InAs/GaAs type-I system.

Figure. 1 shows PR spectrum of (a) type-II InAs/GaAsSb submonolayer (SML) QD and (b) type-I InAs/GaAs SML QD. Each transition such as GaAs, spin orbit splitting, QD and FKO was addressed.

The inset of Fig. 1 (a) shows that as increasing the excitation laser intensity the Franz-Keldysh oscillations (FKOs) start to appear and their periods are extended for InAs/GaAsSb type-II sample. This phenomenon is attributed to the localized electric field due to the bend bending effect caused by the spatially separated photo-excited carriers in the interface region of type-II band alignment structure [1], because appearance of FKOs in the PR spectrum above bulk band gap is caused by an existence of electric field in an interface of a sample [2]. In contrast, for InAs/GaAs type-I system, the PR spectra in the inset of Fig. 1 (b) show that FKOs do not change even at high excitation laser intensity due to the absence of localized electric field in the interface region. The presence of localized electric field was proved and the field's magnitude can approximately be obtained.

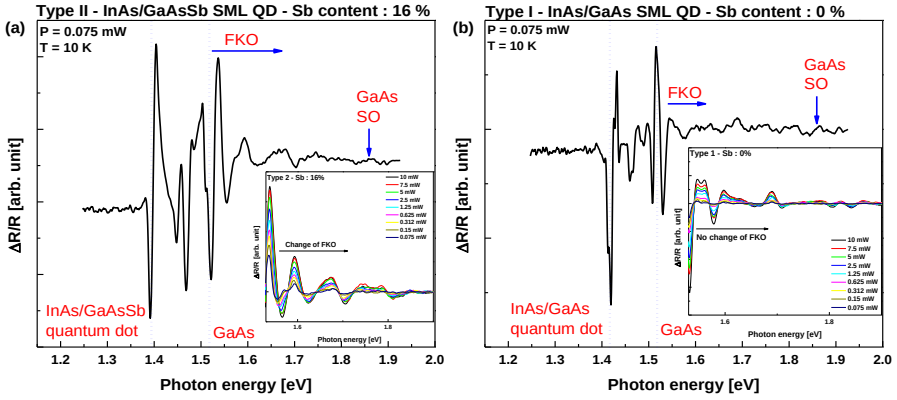

Figure 1. Photoreflectance spectra of (a) type-II InAs/GaAsSb SML QD and (b) type-I InAs/GaAs SML QD. The insets of (a) and (b) show the change of FKOs with various excitation laser intensities.

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[2] C. Van Hoof, K. Deneffe, J. De Boeck, J. D. Arent and G. Borghs, *Appl. Phys. Lett*. 54, **608** (1989).