Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Properties of InGaAs/InAlAs double quantum wells toward spin-filtering application[1] TAKAAKI KOGA, SHOICHIRO YOKOTA, TAKASHI YAMASHIGE, ATSUSHI SAWADA, TORU MATSUURA, Hokkaido University, SEBASTIEN FANIEL, Université catholique de Louvain, SATOFUMI SOUMA, Kobe University, YOSHIAKI SEKINE, HIROKI SUGIYAMA, NTT Corporation
— We recently determined the intrinsic constant for the Rashba effect in (001)InP-matched InGaAs/InAlAs quantum wells (QW) [1]. We now apply this knowledge to band-engineer a spin-filter based on the double QW (DQW) [2]. Firstly, we studied the subband energy spectra of the InGaAs/InAlAs DQW from the beatings in the Shubnikov de Haas (SdH) oscillations. The basic properties obtained here provide useful information to refine the device structures for the spin-filter devices based on the DQW system [2]. In our DQW samples, a thin barrier layer of $In_{0.52}Al_{0.48}As$ ($d_B = 1.5\sim5$ nm) is sandwiched with non-doped QW layers of $In_{0.53}Ga_{0.47}As$ ($d_{QW} =$ 10 nm). By carefully tuning the doping densities above and below the DQW part and the top-gate voltage, the potential profile of this DQW should be ideally made symmetric about the middle barrier layer, though not yet realized in our experiment. The experimental results of our not-yet-ideal DQW samples showed clear beatings in the SdH data, which originate from both the subband and Rashba splittings. We report on our successful separation of these two effects based on the proper band-bending assumptions.

[1] Faniel, et.al., Phys. Rev. B **83**, 115309 (2011).
[2] Souma, et.al, arXiv:1304.6992.

[1]This work was supported by JSPS KAKENHI Grant Number 23360001.

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Date submitted: 06 Nov 2013 Electronic form version 1.4