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Evaluation of spin orbit interactions in InAs quantum well structure using electrical method JOONYEON CHANG, YOUN HO PARK, HYUNG-JUN KIM, SUK HEE HAN, Korea Institute of Science and Technology, JONGHWA EOM, Sejong University, HEON-JIN CHOI, Yonsei University, HYUN CHEOL KOO, Korea Institute of Science and Technology — Spin-orbit interactions are very interesting phenomena in solid state physics because they provide a way that an electric field can control spin information. In a two-dimensional system, the Rashba field arising from structural inversion asymmetry can be modulated by applying an external gate voltage. The Dresselhaus field which results from bulk inversion asymmetry is relatively difficult to detect in a quantum well structure. Both Rashba and Dresselhaus effects have been actively investigated. However, they are phenomenologically inseparable so the evaluation of their individual parameters is not simple. In this study, we determined the absolute value of the Rashba and Dresselhaus parameters separately for an InAs-based quantum well layer via an electrical method. The Rashba spin-orbit interaction effective field is always in the plane of the two-dimensional electron gas and perpendicular to the carrier wavevector but the direction of the Dresselhaus field depends on the crystal orientation. These two spin-orbit interaction parameters can be determined separately by measuring and analyzing the Shubnikov-de Haas oscillations for various crystal directions. In the InAs quantum well system investigated, the Dresselhaus term is just 5% of the Rashba term. The gate dependence of the oscillation patterns clearly shows that only the Rashba term is modulated by an external electric field.

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