

課題番号 : F-20-UT-0161
 利用形態 : 機器利用
 利用課題名(日本語) : InAs/(Ga,Fe)Sb の磁気伝導現象特性評価
 Program Title (English) : Evaluation of magnetotransport phenomena in InAs/(Ga,Fe)Sb
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1. 概要(Summary)

Odd-parity magnetoresistance (OMR), in which an electrical resistance R changes as an odd function of the applied magnetic field, is a highly unconventional phenomenon only observed in a few systems. The resistance change is tiny, reaching at most 2%, and cannot be controlled by an electrical means due to their metallicity.

2. 実験(Experimental)

【利用した主な装置】

8 インチ汎用スパッタ装置

高密度汎用スパッタリング装置

【実験方法】

We first patterned the MBE-grown heterostructure samples into $100 \times 600 \mu\text{m}^2$ Hall bars by standard photolithography and Ar ion milling and then formed several electrodes via electron-beam evaporation and lift-off of sputtered Au (50 nm)/Cr (5 nm) films. The depth of milling reached the AlSb buffer layer. To avoid current leakage through the buffer layer, we deposited SiO_2 by the sputtering between the Au pad and the AlSb buffer for passivation.

3. 結果と考察(Results and Discussion)

Here we report a new giant gate-controlled OMR observed in one-dimensional edge channels, formed by the Fermi level pinning at the side surface, in bilayer heterostructures consisting of nonmagnetic semiconductor InAs and ferromagnetic semiconductor (Ga,Fe)Sb. The OMR in our system reaches 13.5% at 14 T, which is the largest value ever reported. Also, we found that simultaneous

breaking of both spatial inversion symmetry and time reversal symmetry due to the strong magnetic proximity effect (MPE) at the interface between InAs/(Ga,Fe)Sb is the main origin of the large OMR (Fig.1). We also successfully control the OMR using a gate voltage, which alters the MPE at the InAs/(Ga,Fe)Sb interfaces.

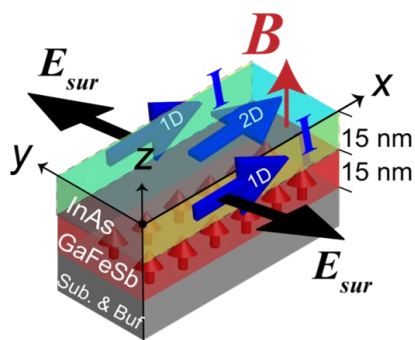


Fig.1 Schematic image of InAs/(Ga,Fe)Sb with both broken spatial inversion symmetry and time reversal symmetry.

4. その他・特記事項(Others)

なし

5. 論文・学会発表(Publication/Presentation)

- K. Takiguchi *et al.*, arXiv 2003.11731 (2020).
- ○K. Takiguchi, L. D. Anh, T. Chiba and M. Tanaka; “Giant gate controlled odd-parity magnetoresistance in one-dimensional channels with a magnetic proximity effect”, American Physical Society March meeting, Online, 16 March 2021. (国際、ポスター、査読なし)

6. 関連特許(Patent)

なし