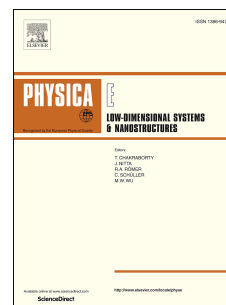


Accepted Manuscript

Spin- and valley-dependent electrical conductivity of ferromagnetic group-IV 2D nanosheets in the topological insulator phase

Bui Dinh Hoi, Mohsen Yarmohammadi, Kavous Mirabbaszadeh, Hamidreza Habibiyan



PII: S1386-9477(17)31474-1

DOI: [10.1016/j.physe.2017.11.013](https://doi.org/10.1016/j.physe.2017.11.013)

Reference: PHYSE 12961

To appear in: *Physica E: Low-dimensional Systems and Nanostructures*

Received Date: 26 September 2017

Revised Date: 2 November 2017

Accepted Date: 12 November 2017

Please cite this article as: B.D. Hoi, M. Yarmohammadi, K. Mirabbaszadeh, H. Habibiyan, Spin- and valley-dependent electrical conductivity of ferromagnetic group-IV 2D nanosheets in the topological insulator phase, *Physica E: Low-dimensional Systems and Nanostructures* (2017), doi: 10.1016/j.physe.2017.11.013.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Spin- and valley-dependent electrical conductivity of ferromagnetic group-IV 2D sheets in the topological insulator phase

Bui Dinh Hoi^{a,b}, M. Yarmohammadi^{c,*}, Kavoos Mirabbaszadeh^d, Hamidreza Habibiyani^d

^a*Institute of Research and Development, Duy Tan University 03 Quang Trung, Da Nang, Viet Nam*

^b*Department of Physics, Hue University's College of Education, 34 Le Loi, Hue City, Viet Nam*

^c*Young Researchers and Elite Club, Kermanshah Branch, Islamic Azad University, Kermanshah, Iran*

^d*Department of Energy Engineering and Physics, Amirkabir University of Technology, Tehran, Iran*

Abstract

In this work, based on the Kubo-Greenwood formalism and the $\mathbf{k}\cdot\mathbf{p}$ Hamiltonian model, the impact of Rashba spin-orbit coupling on electronic band structure and electrical conductivity of spin-up and spin-down subbands in counterparts of graphene, including silicene, stanene, and germanene nanosheets has been studied. When Rashba coupling is considered, the effective mass of Dirac fermions decreases significantly and no significant change is caused by this coupling for the subband gaps. All these nanosheets are found to be in topological insulator quantum phase at low staggered on-site potentials due to the applied perpendicular external electric field. We point out that the electrical conductivity of germanene increases gradually with Rashba coupling, while silicene and stanene have some fluctuations due to their smaller Fermi velocity. Furthermore, some critical temperatures with the same electrical conductivity values for jumping to the higher energy levels are observed at various Rashba coupling strengths. For all structures, a broad peak appears at low temperatures in electrical conductivity curves corresponding to the large entropy of systems when

*Corresponding author

Email address: m.yarmohammadi69@gmail.com (M. Yarmohammadi)

Download English Version:

<https://daneshyari.com/en/article/7933896>

Download Persian Version:

<https://daneshyari.com/article/7933896>

[Daneshyari.com](https://daneshyari.com)