ТЕЗИСЫ ДОКЛАДОВ

МЕЖДУНАРОДНАЯ КОНФЕРЕНЦИЯ
«Перспективные материалы с иерархической структурой для новых технологий и надежных конструкций»

X МЕЖДУНАРОДНАЯ КОНФЕРЕНЦИЯ
«Химия нефти и газа»

Томск

Издательский Дом ТГУ

2018

DOI: 10.17223/9785946217408/597

FORMATION OF INTERFACES BETWEEN TOPOLOGICAL AND MAGNETIC INSULATORS

[1,2,3]Eremeev S.V., [2,3,4]Otrokov M.M., [2,3,4,5]Chulkov E.V.
[1]*Institute of Strength Physics and Materials Science SB RAS, Tomsk, Russia*
[2]*Tomsk State University, Tomsk, Russia*
[3]*Saint Petersburg State University, Saint Petersburg, Russia*
[4]*Departamento de Física de Materiales UPV/EHU, Centro de Física de Materiales CFM - MPC and Centro Mixto CSIC-UPV/EHU, San Sebastián/Donostia, Spain*
[5]*Donostia International Physics Center (DIPC), San Sebastián/Donostia, Spain*

Since the discovery of three dimensional topological insulators (TIs), the time-reversal symmetry breaking and surface band gap opening have been considered as core ingredients for the observation of novel phenomena, like image magnetic monopole or quantum anomalous Hall effect (QAHE). There are two approaches used to break the time-reversal symmetry in TIs or at their surfaces: the doping by transition-metal atoms and magnetic proximity effect. The latter approach based on formation of magnetic insulator (MI) films on the TI surface has several advantages against the former one such as spatially uniform magnetization and absence of the dopant-induced scattering. Recently it has been demonstrated that the MI/TI heterostructure characterized by out-of-plane magnetization and massive Dirac state with the gap of ≈100 meV can be achieved due to spontaneous formation of new MI 2D phase of MnBi2Se4 on the surface of TI [1]. This technique also allows realization of recently proposed planar MI/TI heterostructures on base of related compound MnBi2Te4 [2,3] In fact, both MnBi2Se4 and MnBi2Te4 compounds, predicted to have the same crystal and magnetic phases [4], are structurally and compositionally compatible with a number of the tetradymite-like TIs and therefore are of great potential for construction of the 2D MI/TI heterostructures characterized by non-trivial Chern number. Bulk phases of these van der Waals materials being insulators with interlayer antiferromagnetic coupling for magnetic moments on Mn atoms demonstrate band inversion which makes them antiferromagnetic topological insulators (AFMTI). The AFMTI phase was predicted to be a playground for different fundamental phenomena such as half-integer quantum Hall effect and axion electrodynamics, therefore the discovered MnPn2Ch4 systems can be a solid platform for their realization. The revealed mechanism of the 2D MI/TI interface formation can be expanded to understanding of atomic structure of the MBE grown thick MI films on the substrate of layered topological insulators of the Bi2Se3 family [5].

References

1. T. Hirahara, et al., Nano Lett. 17, 3493 (2017).
2. M.M. Otrokov, et al., 2D Materials 4, 025082 (2017).
3. M.M. Otrokov, et al., JETP Letters 105, 297 (2017).
4. S.V. Eremeev, M.M. Otrokov, E.V. Chulkov, J. Alloys and Compounds 709, 172 (2017).
5. S.V. Eremeev, M.M. Otrokov, E.V. Chulkov, Nano Lett. (accepted)