I-07

STM investigation of 2D alloys and compounds on Si(111) and Ge(111) surfaces

A.A. Saranin[1,2], D.V. Gruznev[1], L.V. Bondarenko[1], A.V. Matetskiy[1], A.Y. Tupchaya[1], A.N. Mihalyuk[1,2], S.V. Eremeev[3], C.-R. Hsing[4], C.-M. Wei[4], S. Ichinokura[5], R. Hobara[5], A. Takayama[5], S. Hasegawa[5], A.V. Zotov[1,2,6]

[1] *Institute of Automation and Control Processes FEB RAS, 690041, Vladivostok, Russia*
[2] *Far Eastern Federal University, School of Natural Sciences, 690950, Vladivostok, Russia*
[3] *Institute of Strength Physics and Materials Science, 634050, Tomsk, Russia*
[4] *Institute of Atomic and Molecular Sciences, Academia Sinica, 23-166, Taipei, Taiwan*
[5] *Department of Physics, University of Tokyo, 113-0033, Tokyo, Japan*
[6] *Dept. of Electronics, Vladivostok State Univ. of Econ. and Services., 690600, Vladivostok, Russia*

The Rashba spin splitting in the two-dimensional electron gas systems on semiconductors is considered to be the key concept for many promising spintronics applications. Unfortunately, the most of the metal/silicon systems with spin-split surface state bands are semiconducting. The only known exceptions are the Tl/Si(111)1×1 modified by adsorption of additional Tl [1] and Au/Si(111)√3×√3 modified by adsorption of In, Tl, Cs or Na [2]. In the present study, we propose a novel universal strategy for tailoring the spin-split metallic surface states [3]. The main concept resides in taking the surfaces with spin-split non-metallic surface-state bands and by alloying them with suitable metals to obtain dense reconstructions with spin-split metallic bands. Validity of the approach is demonstrated with Bi/Si(111)√3×√3 alloyed with Na and Tl/Si(111)1×1 alloyed with Pb. The later Si(111)√3×√3-(Tl, Pb) reconstruction consists of one monolayer of Tl with one-third monolayer of Pb displays 2D superconductivity [4]. Other Tl-based 2D compounds on Si(111) surface will be considered including one-atomic-layer-thick Tl_xBi_{1-x} which represents a quasi-periodic tiling structures that are built by a set of tiling elements as building blocks [5] and double layer sandwichlike structure of one monolayer of Tl and one monolayer of Sn [6] will be discussed.

The work was supported by the Russian Science Foundation (Grant 14-12-00479).

1. K. Sakamoto et al., Nature Commun. 4, 2073 (2013).
2. L.V. Bondarenko et al., Sci. Rep. 3, 1826, (2013).
3. D.V. Gruznev et al., Sci. Rep. 4, 4742, (2014).
4. A.V. Matetskiy et al., Phys. Rev. Lett. 115, 147003 (2015).
5. D.V. Gruznev et al., Sci. Rep. 5, 19446, (2015).
6. D.V. Gruznev et al., Phys. Rev. B, 91, 35421 (2015).