Takamura (Yukiko) Group

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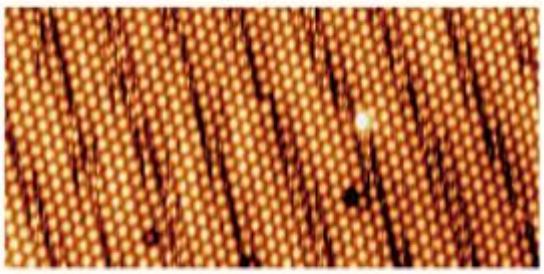
Development of Nanomaterials Based on the Understanding of Surfaces and Interfaces

Outline

Modern industry is founded on thin film materials technologies, ranging from protective coatings to electronic devices, and in order to improve their performance, controlling film-substrate interfaces is critical. The surfaces and interfaces become even more important in the growth of nanomaterials and their properties, since the bulk part is reduced and the surfaces and interfaces become dominant. Our aim is to develop new nanomaterials based on the atomistic understanding of surfaces and interfaces, with the support of advanced microscopies, such as scanning tunneling microscopy and transmission electron microscopy. The hottest topic in our group, right now, is the study of Si-version graphene, "silicene" , which is an ultimate Si-made nanomaterial with single-atom thickness. We found this new two-dimensional material while trying to understand the surface structure of diboride thin films grown on Si wafers. "Silicene" is the fruit of successful collaboration with the photoelectron spectroscopy group and the first-principles calculation group in JAIST.



Recent selected publications

1. “Microscopic origin of the π states in epitaxial silicene”, A. Fleurence, Y. Yoshida, C.-C. Lee, T. Ozaki, Y. Yamada-Takamura, and Y. Hasegawa, Appl. Phys. Lett. 104 (2014) 021605.
2. “First-principles study on competing phases of silicene: Effect of substrate and strain”, C.-C. Lee, A. Fleurence, R. Friedlein, Y. Yamada-Takamura, and T. Ozaki, Phys. Rev. B 88 (2013) 165404.
3. “Mechanisms of parasitic crystallites formation in ZrB2(0001) buffer layer grown on Si(111)”, A. Fleurence, W. Zhang, C. Hubault, and Y. Yamada-Takamura, Appl. Surf. Sci. 284 (2013) 432-437.
4. “Tuning of silicene-substrate interactions with potassium adsorption”, R. Friedlein, A. Fleurence, J. T. Sadowski, and Y. Yamada-Takamura, Appl. Phys. Lett. 102 (2013) 221603.
5. “Experimental evidence for epitaxial silicene on diboride thin films”, A. Fleurence, R. Friedlein, T. Ozaki, H. Kawai, Y. Wang, and Y. Yamada-Takamura, Phys. Rev. Lett. 108 (2012) 245501.
6. “Surface electronic structure of ZrB_2 buffer layers for GaN growth on Si wafers”, Y. Yamada-Takamura, F. Bussolotti, A. Fleurence, S. Bera, and R. Friedlein, Appl. Phys. Lett. 97 (2010) 073109.

Recent research funds

- Grant-in-Aid for Scientific Research (A), JSPS, 2014-2017, “Interface control of epitaxial silicene”, Y. Yamada-Takamura, 40,820,000 JPY

- Grant-in-Aid for Young Scientists (B), JSPS, 2014-2015, “Formation mechanism of epitaxial silicene”, A. Fleurence, 4,160,000 JPY
- Grant-in-Aid for Research Activity Start-up, JSPS, 2012-2013, “Crystal and electronic structure engineering of epitaxial silicene”, A. Fleurence, 2,990,000 JPY
- Funding Program for Next Generation World-Leading Researchers, JSPS, 2010-2013, “ Surface and interface studies of epitaxial diboride thin films for integration with nitride semiconductors”, Y. Yamada-Takamura, 145,600,000 JPY
- Grant-in-Aid for Scientific Research in Priority Areas, MEXT, 2010, “Study on the role of functional elements in the epitaxial growth of diboride thin films”, Y. Yamada-Takamura, 1,900,000 JPY
- Grant-in-Aid for Young Scientists (A), JSPS, 2007-2009, “Surface and interface control in the epitaxial growth of boride thin films”, Y. Yamada-Takamura, 25,480,000 JPY