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Nanoprobing Charge Transport Properties of Strained and Indented Topological Insulator

Jin Heui Hwang[1], Sangku Kwon[1], Joonbum Park[2], Jhinhwan Lee[3], Jun Sung Kim[2], Ho-Ki Lyeo[4], Jeong Young Park[1]

[1]Graduate School of EEWS, KAIST, Daejeon and Center for Nanomaterials and Chemical Reactions, Institute for Basic Science, Daejeon 305-701, [2]Department of Physics, Pohang University of Science and Technology, Pohang 790-784, [3]Department of Physics, KAIST, Daejeon 305-701, [4]Korea Research Institute of Standards and Science, 267 Gajeong-ro, Yuseong-gu, Daejeon 305-340, Korea

We investigated the correlation between electrical transport and mechanical stress in Bi_2Te_2Se by using a conductive probe atomic force microscopy in an ultra-high vacuum environment. Uniform distribution of measured friction and current were observed over a single quintuple layer terrace, which is an indication of the uniform chemical composition of the surface. By measuring the charge transport of Bi_2Te_2Se surface as a function of the load applied by a tip to the sample, we found that the current density varies with applied load. The variation of current density was explained in light of the combined effect of the changes in the in-plane conductance and spin-orbit coupling that were theoretically predicted. We suppose that the local density of states is modified by tip-induced strain, but topological phase still remains. We exposed a clean topological insulator surface by tip-induced indentation. The surface conductance on the indented Bi_2Te_2Se surface was studied, and the role of surface oxide on the surface conductance is discussed.

Keywords: topological insulators, bismuth compounds, transport, friction, tribology, atomic force microscopy theory

S-004

CO Adsorption and Reaction on Clean and Zn-deposited Au(211) surface

조상완[1], F. Mbuga[2], H. Ogasawara[3], A. Nilsson[3]

[1]연세대학교, [2]Stanford University, [3]SLAC National Accelerator Laboratory

Crucially, effective catalysts must be capable of efficiently catalyzing the protonation of adsorbed CO to adsorbed CHO or COH. One of the strategies is alloying with metals with higher oxygen affinity and Au-Zn alloy is one of the best candidates. At first, we made Au-Zn alloy using vacuum evaporating method. Zn was deposited on the Au(211) surface and the amount was estimated by X-ray photoelectron spectroscopy (XPS) using the relative sensitivity of Au 4f and Zn 3d. We investigated CO adsorption on a clean Au(211) and Au-Zn alloy using temperature-programmed desorption (TPD) and XPS. From the TPD results, we can conclude that the presence of the particular step sites at the Au(211) surface imparts stronger CO bonding and Zn atoms are sitting on the step sites at the Au(211) when Zn is deposited. The XPS results show the oxygen atoms of CO bond Zn atoms on Au-Zn surface. It should be an evidence that alloying Zn atoms that has high oxygen affinity into an electrocatalyst may allow CHO* to bind to the surface through both the carbon and oxygen atoms.

Acknowledgements

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (2013R1A1A4A01011392).

Keywords: CO2, CO, reduction, XPS, TPD, catalyst