

S-003

## Nanoprobng Charge Transport Properties of Strained and Indented Topological Insulator

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We investigated the correlation between electrical transport and mechanical stress in Bi<sub>2</sub>Te<sub>2</sub>Se 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<sub>2</sub>Te<sub>2</sub>Se 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<sub>2</sub>Te<sub>2</sub>Se 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

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

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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.

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**Keywords:** CO<sub>2</sub>, CO, reduction, XPS, TPD, catalyst