

## 【Vol. 2】 Report from Naoto Kamiuchi

Dear readers,

In this report, I introduce my research in Prof. Miquel Salmeron's Group and a journey to Yellowstone National Park and Grand Teton National Park.

One purpose of this project is to learn in situ techniques of surface analyses such as high pressure-scanning tunneling microscopy (HP-STM) and ambient pressure-X-ray photoelectron spectroscopy (AP-XPS). In STM, a kind of scanning probe microscopy (SPM), the surface of sample can be imaged with atomic resolution by controlling tunneling current between a tip and a sample due to a feedback system. On the other hand, XPS is a spectroscopy to analyze the electronic state of a sample by measuring the energy of photoelectron. In the first step, I'm learning the basic techniques of STM, for instance, sample transferring, Ar sputtering, annealing, scanning, low energy electron diffraction (LEED) and Auger electron spectroscopy (AES). And, I'm trying to image single crystal surfaces at the temperature of liquid nitrogen (77 K) using a low temperature-scanning tunneling microscopy (LT-STM). Prof. Miquel frequently advises me, and kind postdoctoral researchers in the group support my experiments, because this is my first experience to use STM. In the experiments of STM, there are a lot of difficulties because of my crude technique. For example, baking of microscope chamber or preparation chamber takes at least 1 week to achieve ultra high vacuum ( $< 5 \times 10^{-10}$  mbar), when a sample drops in the chambers, or when a W filament is destroyed. The beautiful night view from LBNL cheers me up, when I am disappointed with a failure in my experiment (photo01).



Photo01 Night view from LBNL

Sometimes, I support other members in this group to study using AP-XPS in SLAC National Accelerator Laboratory of Stanford University (photo02, 03). We become friendly through the experiments at SLAC, because they are conducted on 24-hour schedules.



Photo02 SLAC



Photo03 Hoover Tower (Stanford University)

In summer, I traveled to Yellowstone National Park and Grand Teton National Park with my family. First, we flew from San Francisco to Salt Lake City, and then drove to Yellowstone for 6 hours. In Yellowstone, we saw mysterious basin and geyser (photo04-06) as well as a lot of wild animals of bison and elk (photo07-09). After the sightseeing at Yellowstone National Park, we visited in Grand Teton National Park (photo10), which is next to Yellowstone National Park. In Grand Teton, unfortunately, we cannot see the great mountains due to heavy snow in September. We got refreshed by feeling pristine nature in two national parks.



Photo04 Old Faithful Geyser (Yellowstone National Park)



Photo05 Grand Prismatic Spring (Yellowstone National Park)





Photo06 Landscape of Yellowstone National Park



Photo07, 08 Bison



Photo09 Elk



Photo10 Grand Teton National Park

In the remaining months, I will try to observe the surface of single crystal in atomic resolution and study the interaction between gas molecules and single crystal surface. In addition, I want to learn the techniques in the experiments of HP-STM and AP-XPS.

In the next report, I will summarize my research activity in LBNL.