

# Photoelectron spectroscopy of low dimensional Ni-O complex grown on Ni(755) stepped surfaces

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## 1. Introduction

Periodical arrays of steps and terraces are formed on metal stepped surfaces. New electronic states localized at steps can enhance activity of adsorption [1]. Recently we found the growth of low dimensional Ni-O surface complex on Ni(755) [= 6(111) × (100)] by oxygen adsorption [2]. Our STM observation shows that oxygen adsorbs at the step edge around 1L-exposure of oxygen. By further adsorption, Ni-O super cells with the 2×2 structure of Ni(111) are formed at the terrace on the surface. By observing a equi-potential energy surface applied by two-dimensional photoelectron spectroscopy (2D-PES) with a display-type spherical mirror analyzer (DIANA) [3], we tried to analyze dimensional characteristics of the electronic states of those Ni-O super cells. In this note, we report preliminary results of photoelectron spectroscopy of those surface complexes.

## 2. Experimental

The experiment was performed at the linearly polarized soft x-ray beamline BL-7 equipped with a two-dimensional photoelectron spectrometer at SR center, Ritsumeikan University [4]. Surface cleanness and oxygen adsorption were evaluated by LEED and Auger electron spectroscopy. Photon energy for 2D-PES was 40 eV and the total energy resolution of the present measurements was about 0.4 eV.

## 3. Results and Discussion

Figure 1 shows the angle-integrated energy distribution curves measured on the clean and the oxygen adsorbed surfaces of Ni(755). On the clean surface, the bands near the Fermi

level are mainly due to Ni 3*d* and the weak structure around 6 eV may be the well-known satellite of Ni [5]. By 1 L-O<sub>2</sub> adsorption, new electronic states emerge around 7 eV. By further O<sub>2</sub> adsorption (2-10 L), a new broad peak is derived around 6 eV. The former peak energy corresponds to the oxygen derived energy state on Ni(100) [6]. The atomic arrangement of the step sites on Ni(755) is 4-fold with a (100)-like structure. It is already confirmed by STM that the adsorption sites of oxygen at this exposure is the step. This implies that the oxygen-induced electronic states are localized at steps.

The latter peak at 6 eV can be compared with the energy states of the 2×2 structure of O/Ni(111) in the previous report [7]. STM at this stage of the adsorption shows the growth of the 2x2 super cells at the terrace on the surface. The atomic arrangement of the terrace on Ni(755) is Ni(111)-like structure. This broad peak may be due to the electronic states of Ni-O super cells grown at the terrace on the surface.

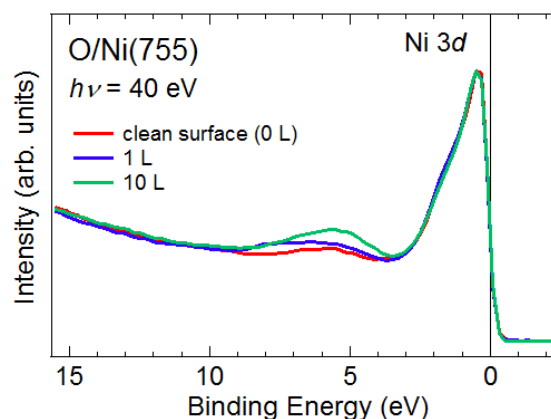
Although the present measurements of photoelectron spectroscopy are still preliminary, the electronic states derived by the oxygen adsorption at the step and the terrace are well-resolved.

#### 4. Conclusion

We have measured and analyzed the evolution of the electronic states on Ni(755) stepped surface by O<sub>2</sub> adsorption.

#### References

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**Fig. 1** Photoelectron spectra of Ni(755) stepped surface by O<sub>2</sub> adsorption taken with  $h\nu = 40$  eV.