[Ⅲ~22]

Nanofabrication of Co wires on the vicinal Cu(111)

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The Co/Cu system has been known to have the oscillatory magnetic coupling behavior from ferromagnetic to antiferromagnetic according to the thickness of Cu space-layer. Therefore, in order to investigate such intricate magnetic behavior, it is essential to fabricate the nanostructure in the controlled fashion. However, the Co overlayer deposited on Cu(111) at 300 K is quite unstable, and Cu atoms segregates to cover Co overlayer. In the present study, the Co wires were fabricated on 2-degrees-off vicinal Cu(111) utilizing the fact that the *reasonable* number of steps can act as nucleation sites. Thermally evaporated Co on the vicinal Cu(111) was *in-situ* analyzed by high resolution ($\triangle E < 0.2$ eV) ultraviolet photoelectron spectroscopy (UPS), x-ray photoelectron spectroscopy (XPS), low energy electron diffraction (LEED), and photoemission of adsorbed Xenon (PAX). Prior to Co deposition, obtained was the clean-surface Xe standard, which manifests that Xe preferentially adsorbs at step sites with 0.3 eV lower work-function than that of the terrace. The second layer Xe, with 0.6 eV higher binding energy than that of the first one, indicates the same amount of work-function is lowered by the adsorbed Xe. Such multilayer Xe adsorption technique to disclose the underlying surface morphology as well as work function, was applied to the Co deposited Cu surfaces at room temperature (RT) as well as low temperature (LT), 40 K. In the RT Co-depositions (1, 4, and 6Å), the arriving Co moves to the steps and the uncovered terrace of Cu(111) was widely open for Xe to be stacked in the similar fashion to that of the clean surface. Such results are quite different from those of RT Co deposition on the flat Cu(111) surface. On the other hand, even 1 Å of Co deposition at 40 K was enough to remove such flat terrace where Xe can be stacked in the similar fashion to that of the clean surface. Even post-annealing above RT could not send Co atoms to the step edges but induce clustering. From the present studies, it can be deduced that, in order to form the wire at the step edge, the Co diffusion-length (prior to clustering themselves) should be longer than the terrace width.

* The present study was supported by STEPI.