

PEEM/EXPEEM Investigation of the Au on Ta Polycrystalline

Testuya Tsutsumi, Takeshi Miyamoto, Hironobu Niimi, Yoshinori Kitajima*,
Yuji Sakai**, Makoto Kato** and Kiyotaka Asakura

Catalysis Research Center, Hokkaido University, Sapporo 001-0021, Japan

**Photon Factory, Institute for Material Structure Science Oho 305-0801, Japan*

***JEOL, Akishima 196-8558, Japan.*

Au film on Ta metal is interesting in the standpoint of electronic structure and intermixing in the subsurface layer.[1] We have deposited Au islands on Ta polycrystalline and observed the changing of Au morphology and its chemical state by PEEM (Photoemission Electron Microscopy) and EXPEEM (Energy Filtered X-ray PEEM) to see the thermal behavior of the Au island film.

The experiments were carried out in a UHV chamber equipped with a Wien-filter type EXPEEM instrument.[2] The PEEM was measured using a deuterium lamp focused with a lens. EXPEEM measurements were carried out at BL2A of Photon Factory (KEK-PF) using synchrotron radiation. The X-ray energy was 2300 eV, monochromatized by Ge(111).

Figure 1 shows the PEEM and EXPEEM images of Au islands on Ta polycrystalline. At room temperature, the Au island was brighter than the Ta area. Since the work function of Ta is smaller than that of Au, the Ta region should be brighter. This was because of the O and C contaminations which were hardly removed from the surface. We heated the sample up to 723 K(b) and 773 K(c), the Ta area became brighter due to the removal of C. At 1100 K, the Au region became brighter again. We could not observe the Au pattern in the Au $3d_{5/2}$ EXPEEM image(d).

At 1100 K, most of Au might desorb. However, Au easily makes alloy with Ta and the part of Au migrated into the subsurface region. Consequently the inward dipole moment was created and the Au region became brighter.

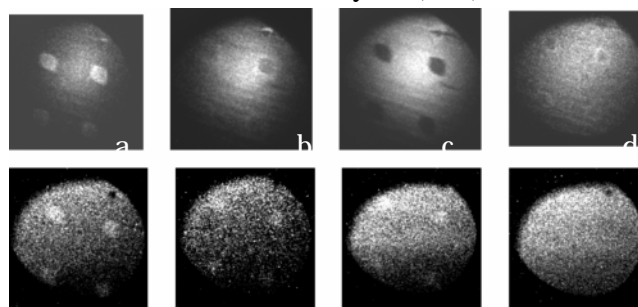


Fig.1 PEEM(upper) and Au $3d_{5/2}$ EXPEEM(lower) pictures of Au/Ta heated at RT(a), 723K(b), 773 K(c) and 1100 K(d)

[1] E. Huger, H. Wormeester, K. Osuch, Surf. Sci. 580 (2005) 173; S. Stepanovskyy, I. Ubogyi, J. Kolaczkiwicz, Surf. Sci. 572 (2004) 206; J. Kolaczkiwicz, M. Kuchowicz, R. Szukiewicz, Surf. Sci. 548 (2004) 246

[2] H. Yasufuku, Y. Ohminami, T. Tsutsumi, K. Asakura, M. Kato, Y. Sakai, Y. Kitajima, Y. Iwasawa, Chem. Lett. (2002) 842; H. Yasufuku, Y. Ohminami, T. Tsutsumi, H. Niimi, N. Matsudaira, K. Asakura, M. Kato, Y. Sakai, Y. Kitajima, Y. Iwasawa, Jpn. J. Appl. Phys. 43 (2004) 7682.