7A/99G-078

ENREGY-DISPERSIVE NEXAFS MEASUREMENT: DECOMPOSITION OF METHOXY ON NI(111)

Masaoki IWASAKI, Hiroshi KONDOH*, Ikuyo NAKAI, Akira NAMBU, Kenta AMEMIYA
Toshihiko YOKOYAMA and Toshiaki OHTA
Department of Chemistry, Graduate School of Science, The University of Tokyo, Hongo, Tokyo 113-0033, Japan

Introduction

Energy-dispersive near-edge X-ray absorption fine structure (NEXAFS) is a powerful method for in-situ investigation of mechanisms or inetrmediate products of chemical reactions. In the present work we have studied decomposition of methoxy on Ni(111). As this system has already been the subject of many experimental investigation, it provides an excellent opportunity to test the capabilities of energy-dispersive NEXAFS. By using this method, it is possible to record NEXAFS spectra within a few seconds and, hence, to directly monitor what is going on the surface during the reaction.

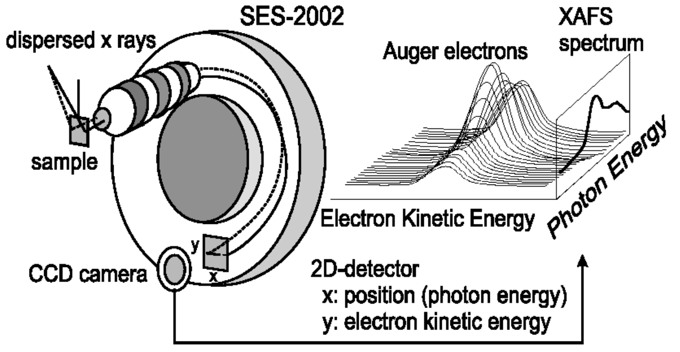

fig.1 experimental setup for dispersive NEXAFS

Experimental

The experiments were perfomed at BL-7A. Photons with 20eV width can be dispersed to 4 mm long irradiated zone on the sample. A position sensitive electron energy analyzer (SCIENTA SES-2002) was used, by which electrons emitted from one spot can be forcused at a certain spot on the micro-channel plate. Thus the combination of the energy-dispersed X-rays and the position sensitive electron energy analyzer enables us to take NEXAFS spectra in a very efficient way based on the Auger electron yield method (fig.1).The methoxy layer was prepared by exposing a Ni(111) surface to methanol at 200 K.

Results and discussion

In fig.2 (a) and (b) are shown O K-edge dispersive NEXAFS spectra of methoxy on Ni(111) taken with heating at a rate of 0.5 K/s (data acquisition rate: 10 sec/spectrum). Two sharp peaks at 531.7 eV and 533.1 eV are assigned to 1s→2e (MeO_{ad}) and 1s→2π* (CO_{ad}) transitions, respectively [1]. O-K XAFS on the same system indicated that the intensity of the 2π* (CO_{ad}) peak considerably larger than that of the 2e (MeO_{ad}) peak. The significant increase of the peak intensity ovserved from 240 K indicates that conversion from MeO_{ad} to CO_{ad} starts at around 240 K, which is consistent with a previous IRAS study [2]. In fig.2 (b) an abrupt decrease of the 2π* (CO_{ad}) peak is observed at 385 K, which is due to desorption of CO. Another peak gradually appeared at a lower photon energy. This peak is associated with atomic oxygen, which came from O_2 introduced into the chamber with a pressure of 1.2×10^{-8} Torr. Thus, it is confirmed that the dispersive NEXAFS is a useful technique to trace surface processes such as adsorption, desorption and chemical reaction.

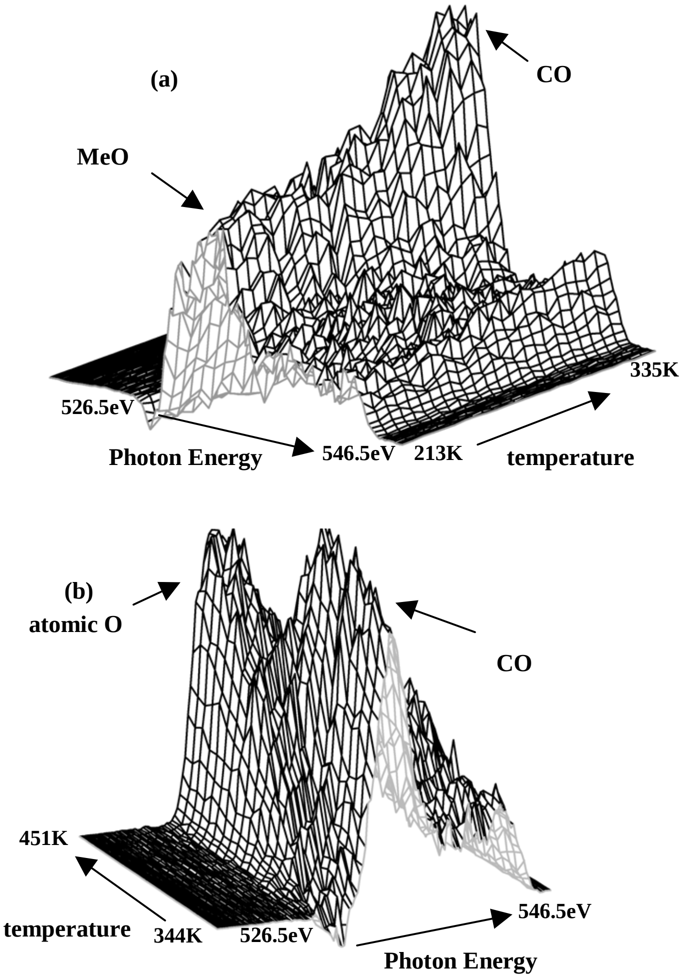

fig.2(a), (b): O-K dispersive NEXAFS spectra from MeO-/Ni(111) at normal incidence
(a) 213 K-335 K (b) 334 K-451 K

Referrence

[1] K.Amemiya et al., *Phys.Rev.B.* **59,** 2307 (1999)
[2] J.Huberty et al., *Surf.Sci.* **334,** 77 (1995)

*kondo@chem.s.u-tokyo.ac.jp