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Topmost-Surface-Sensitive Si-2*p* Photoelectron Spectra of Clean Si(100)-2×1 Measured with Photoelectron Auger Coincidence Spectroscopy

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Introduction

Topmost surface sites play the most important role in surface chemical reactions. Conventional photoelectron spectroscopy (PES), however, offers averaged information of surfaces, and their surface sensitivity is limited because the inelastic mean free path of low-energy electrons reaches several Ångströms (Å). In the present paper we report Si-2*p* PES of a clean Si(100)-2×1 surface measured by photoelectron Auger coincidence spectroscopy (PEACS) [1]. Owing to the extremely short escape depth of PEACS electrons [2] (~1.2 Å in the present case), we have succeeded to measure topmost-surface-sensitive Si-2*p* PES.

Results and Discussions

Figure 1 shows a Si-$L_{23}VV$ Auger electron spectrum of a Si(100)-2×1 clean surface at room temperature. The dashed line at the relative *AeKE* = +2.0 eV shows the energy position taken as trigger signal for Si-2*p*-Si-$L_{23}VV$ PEACS measurements. Figure 2 shows a conventional Si-2*p* photoelectron spectrum and a Si-2*p*-Si-$L_{23}VV$ PEACS spectrum measured in coincidence with Si-$L_{23}VV$ Auger-electrons at the relative *AeKE* of +2.0 eV (see Fig. 1). These spectra were decomposed into four surface components and one bulk component by a curve fitting using Voigt functions. The peak assignments are also

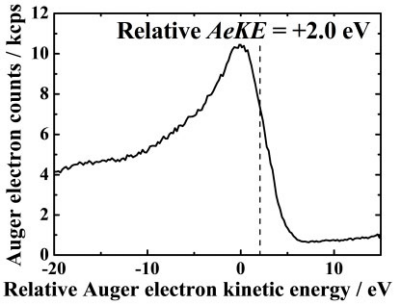

Fig. 1. Si-$L_{23}VV$ Auger electron spectrum of a Si(100)-2×1 clean surface in the relative Auger-electron kinetic energy (*AeKE*) scale, where the maximum peak is taken as the origin.

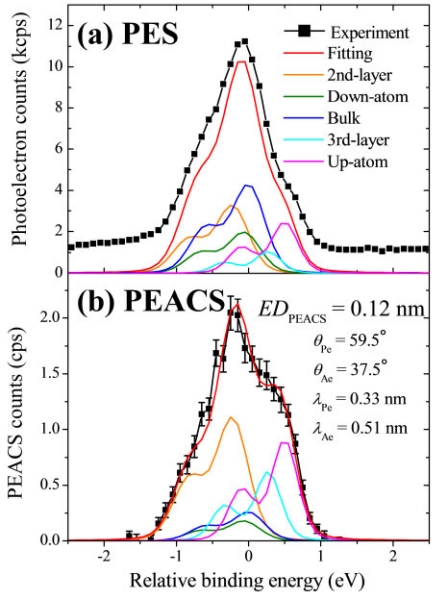

Fig. 2. (a) Conventional Si-2*p* photoelectron spectrum. (b) Si-2*p* photoelectron – Si $L_{23}VV$ Auger electron coincidence spectrum in the relative binding energy scale, where the Si-$2p_{3/2}$ peak of the bulk is taken as the origin.

shown in Fig. 2. In the PEACS spectrum the component of the Si down-atoms is considerably suppressed (–8%), while the components of the Si up-atoms, the Si 2nd-layer are enhanced (+11% and +13%), suggesting that the major $L_{23}VV$ Auger components at relative *AeKE* of +2.0 eV are the Si up-atoms and the Si 2nd-layer. Since PEACS can be applied to any surfaces, the present study opens a new approach to identify PES components.

References

[1] T. Kakiuchi *et al.*, Surf. Sci. **604**, L27 (2010).
[2] G. A. Sawatzky: in *Auger electron spectroscopy* eds. C. L. Briant and R. P. Messer (Academic Press, San Diago, 1988) Chap. 5, p. 167-243.
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