

# Real-time observation of surface chemical reaction at millisecond resolution by means of soft X-ray dispersive XAFS

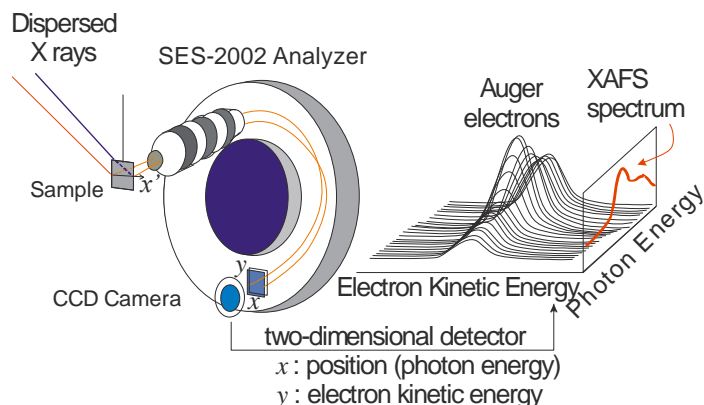
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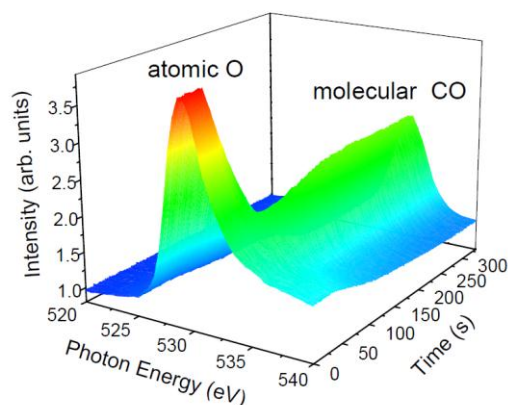
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A dispersive XAFS technique in the soft X-ray region has been developed, as illustrated in Fig. 1, to realize the real-time observation of surface chemical reactions at one event, and a time resolution of 33 ms [1] or faster has been achieved. The observation of the CO oxidation reaction on Ir(111) surface is shown in Fig. 2 as an example. The coverage of each species at the surface during the reaction is quantitatively estimated from a series of XAFS spectra. Moreover, the observation of the changes in the molecular orientation within one reaction has been also achieved [2] by combing the dispersive XAFS technique with polarization switching [3] between the horizontal and vertical linear polarizations.



**Fig. 1.** Schematic layout for dispersive XAFS measurement. The position,  $x'$ , on the sample surface corresponds to the photon energy. The Auger electrons emitted at  $x'$  after X-ray absorption are separately corrected at  $x$  on the two-dimensional detector, yielding the XAFS spectrum.



**Fig. 2.** Three-dimensional plot of O K-edge XAFS spectra taken at every 33 ms during the exposure of O/Ir(111) surface to  $4 \times 10^{-7}$  Torr CO at 400 K.

[1] K. Amemiya *et al.*, Appl. Phys. Lett. **99**, 074104 (2011).

[2] K. Amemiya *et al.*, Appl. Phys. Lett. **101**, 161601 (2012).

[3] K. Amemiya *et al.*, J. Phys.: Conf. Ser. **425**, 152015 (2013).