

Study of CO oxidation Reaction on Ir(111) under near Atmosphere Pressure using Ambient Pressure XPS (AP-XPS)

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Introduction

In this decade, destruction of environment by automotive exhaust is becoming a more and more serious problem. Study of CO oxidation reaction is potentially useful for giving a solution to this problem since this reaction is one of the elementary steps of the complex reaction occurring at exhaust gas catalysts. The CO oxidation has been studied mostly under ultrahigh vacuum (UHV) conditions so far. Differences in reaction mechanism between UHV and high-pressure conditions have been paid much attention recently. In this work, we studied CO oxidation reaction on Ir(111) under near ambient pressure using AP-XPS.

Experimental section

Clean Ir(111) surfaces were exposed to O₂ and CO gases up to near 1 Torr at 400 K. The partial pressure of gases was monitored by the quadrupole mass spectroscopy (QMS). During the gas exposure, XP spectra were obtained.

Results and Discussion

Fig. 1 shows mass monitoring and fig. 2 shows O1s XP spectra taken under a reaction condition. Each mass measurement (A, B) corresponds to each XP spectrum with the same label. From Fig.1, we could find decreasing of CO production with time. Under condition A (more active), three peaks are observed in the XP spectra.

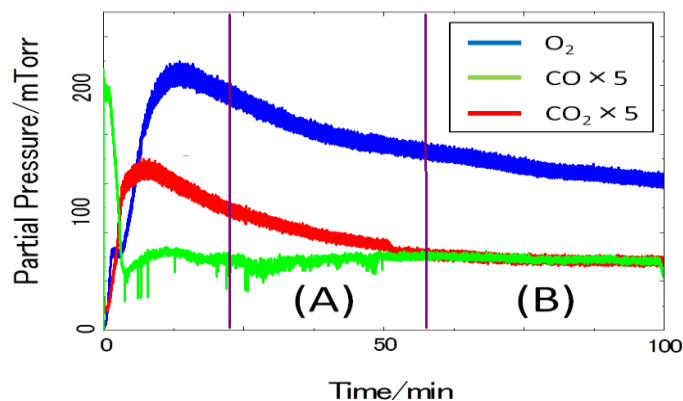


Figure 1: Mass monitoring under a reaction condition.

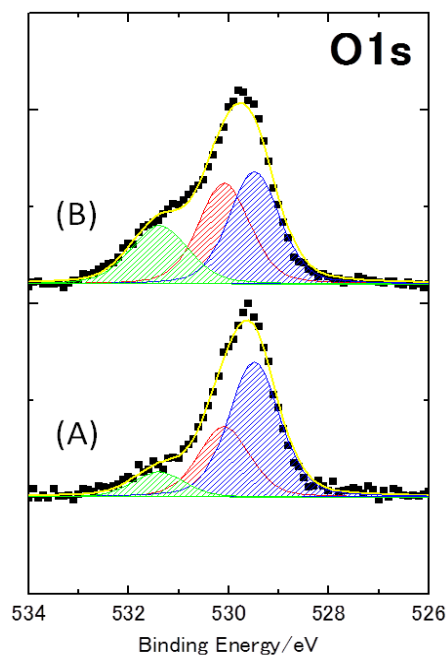


Figure 2: O1s XP spectra taken under a reaction condition.

A peak at 530.1 eV (red) is attributed to chemisorbed O. Another peaks at 529.5 eV and 531.1 eV are associated with the O-Ir-O trilayer surface oxide^[1] which contains two oxygen species. Under condition B (less active), the same three peaks are observed but the intensity ratio was changed. The drastic increase of the green peak suggests growth of the O-Ir-O tri-layer surface oxide. Therefore, we suppose that the presence of the O-Ir-O tri-layer surface oxide suppresses the CO oxidation reaction on the Ir(111) surface. The chemisorbed O species seems to be mainly contributing to the CO oxidation.

Reference

[1] He, Y. B.; Stierle, A.; Li, W. X.; Farkas, A.; Kasper, N.; Over, H. J. Phys. Chem. C 2008, **112**, 11946.

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