Electronic Supplementary Material (ESI) for Catal. Sci. Technol.
This journal is © The Royal Society of Chemistry 2013

Electronic Supplementary Information (ESI)

Structure-activity relation of spinel-type Co-Fe oxides for low-temperature CO oxidation

P. Mountapmbeme Kouotou,[a,*] H. Vieker,[b] Z.Y. Tian,[a,c,*] P.H. Tchoua Ngamou,[a] A. El Kasmi,[a] A. Beyer,[b] A. Gölzhäuser,[b] and K. Kohse-Höinghaus[a]

[a] *Department of Chemistry, Bielefeld University, Universitätsstraße 25, D-33615 Bielefeld, Germany*

[b] *Department of Physics, Bielefeld University, Universitätsstraße 25, D-33615, Bielefeld, Germany*

[c] *Present address: Institute of Engineering Thermophysics, Chinese Academy of Sciences, Beijing 100190, P.R. China*

* Corresponding author.
Z.Y. Tian: Tel/Fax: +86-10 82483184; E-mail: tianzhenyu@iet.cn
P. Mountapmbeme Kouotou. E-mail: Patrick.mountap@uni-bielefeld.de

Table ESI 1: Estimated composition at the surface of the Co-Fe thin films.

	C1s	O1s	Co2p	Fe2p	Co/Fe	Co	Fe	O
$Co_{0.9}Fe_{2.1}O_4$	43%	49%	3%	6%	0.43	0.9	2.1	4
$Co_{1.8}Fe_{1.2}O_4$	37%	51%	7%	5%	1.47	1.8	1.2	4
$Co_{2.1}Fe_{0.9}O_4$	35%	49%	11%	5%	2.23	2.1	0.9	4

Details about the XPS analysis

The surface composition was determined by the means of X-ray photoelectron spectroscopy (XPS). XPS was done in a multi technique ultra-high vacuum instrument (Multiprobe, Omicron Nanotechnology) using a monochromated Al Kα X-ray source (1486.7 eV, 280 W) and a hemi-spherical electron energy analyzer (Sphera) in constant analyzer energy mode (25 eV) and a step size of 0.05 eV. The sample was located under an angle of 13° from the surface normal to the electron detector. The base pressure of the chamber is 2×10^{-10} mbar. CasaXPS was used to analyze the spectra, and a Shirley background subtraction procedure was employed. The elemental composition was calculated using the area of the Fe2p, Co2p, C1s and O1s peaks with the according Scofield cross-sections. The peak areas of the Fe2p and Co2p signals were corrected for Auger LMM peaks that each metal has in the 2p-area of the other metal. In both cases, mainly the $2p_{3/2}$ parts of the spectra are affected. To do the correction, 2 sputter-cleaned metal oxide samples made by PSE-CVD were measured as references. The intensity correction of the peak area was done according to the following formula:

$$A(\mathrm{Fe}-2\mathrm{p}) = \frac{M(Fe) - K(Co)M(Co)}{1 - (K(C0)K(Fe))} \qquad A(\mathrm{Co}-2\mathrm{p}) = \frac{M(Co) - K(Fe)M(Fe)}{1 - (K(C0)K(Fe))}$$

Definitions:

A = Area

K = [A(LMM) / A(2p)] (Correction factor)

Measured Areas:

M(Fe) = A(Fe-2p+Co-LMM)

M(Co) = A(Co-2p+Fe-LMM)

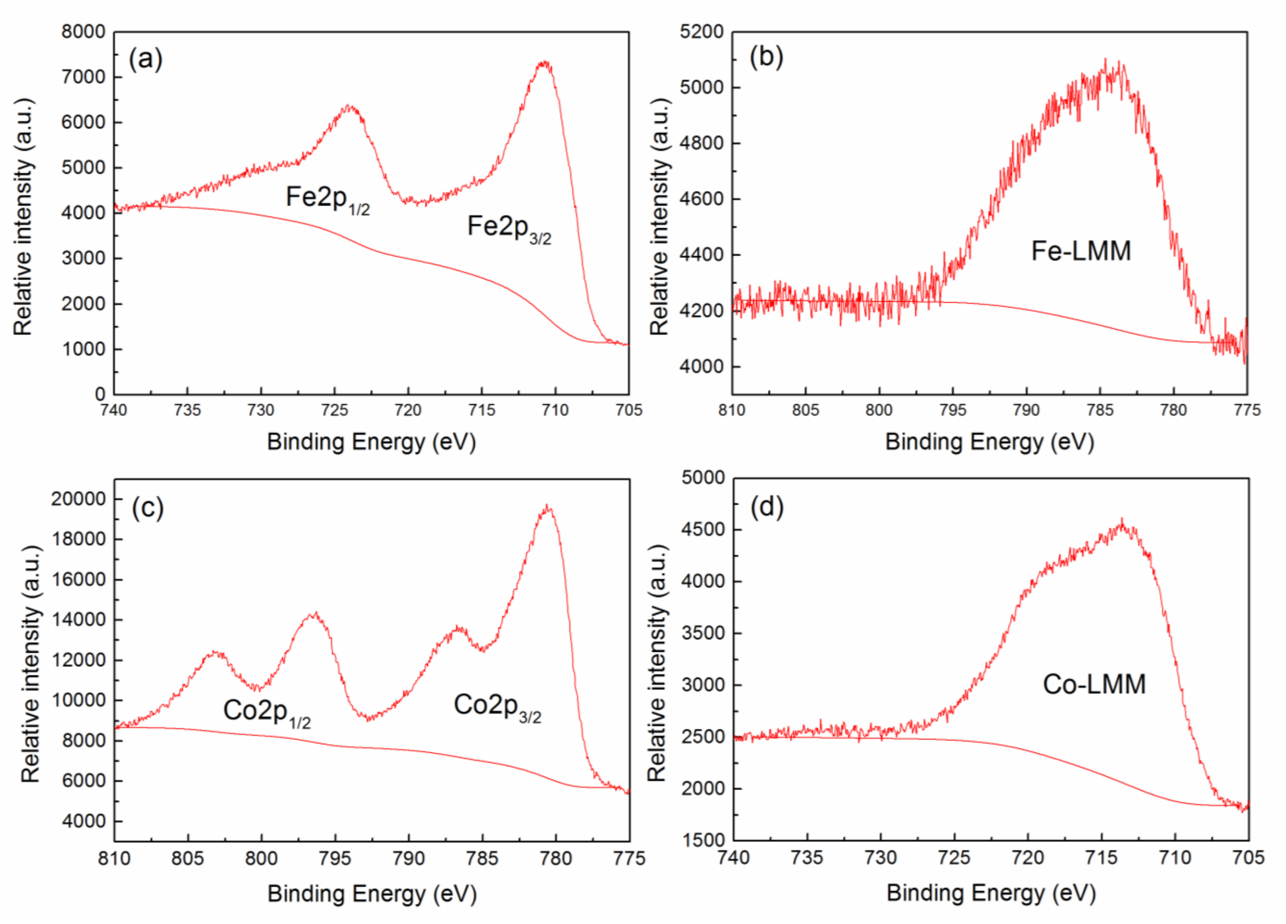

Fig. ESI 1 Pure iron oxide (a, b) and cobalt oxide (c, d) reference sample.

Area ratio K (Fe) = A(Fe-LMM) / A(Fe-2p) = 14.3 / 84.8 = 0.148
Area ratio K (Co) = A(Co-LMM) / A(Co-2p) = 41.1 / 206.8 = 0.210

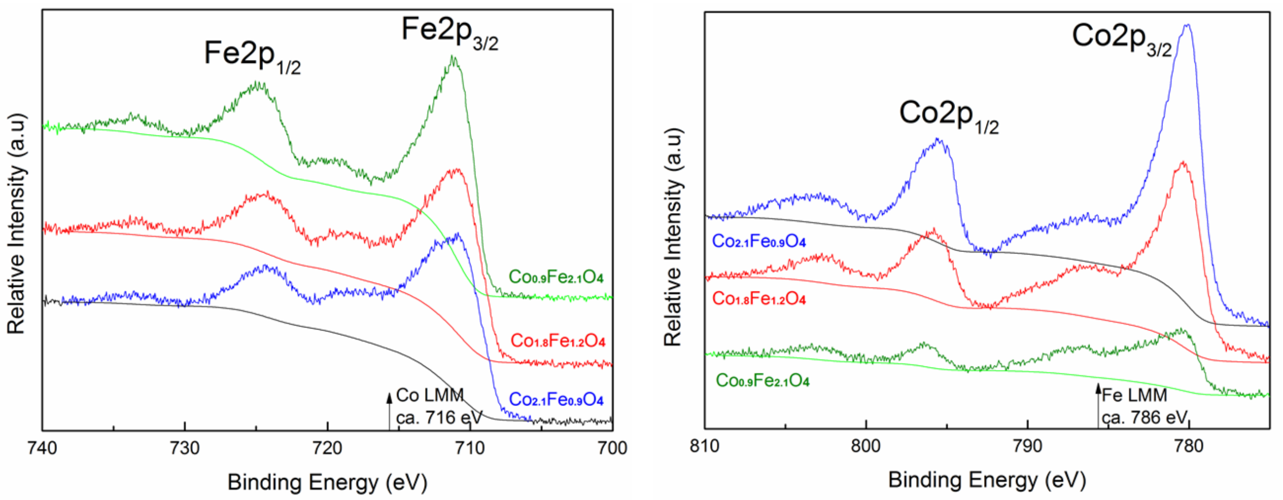

Fig. ESI 2 The original XPS spectra of Fe2p and Co2p with the corresponding Shirley backgrounds. In addition, the subtraction of the Auger signals was done to obtain less-disturbed iron and cobalt spectra. This was done with CasaXPS by subtracting the LMM references from the 2p data (see Fig 2a and 2b in the main text).

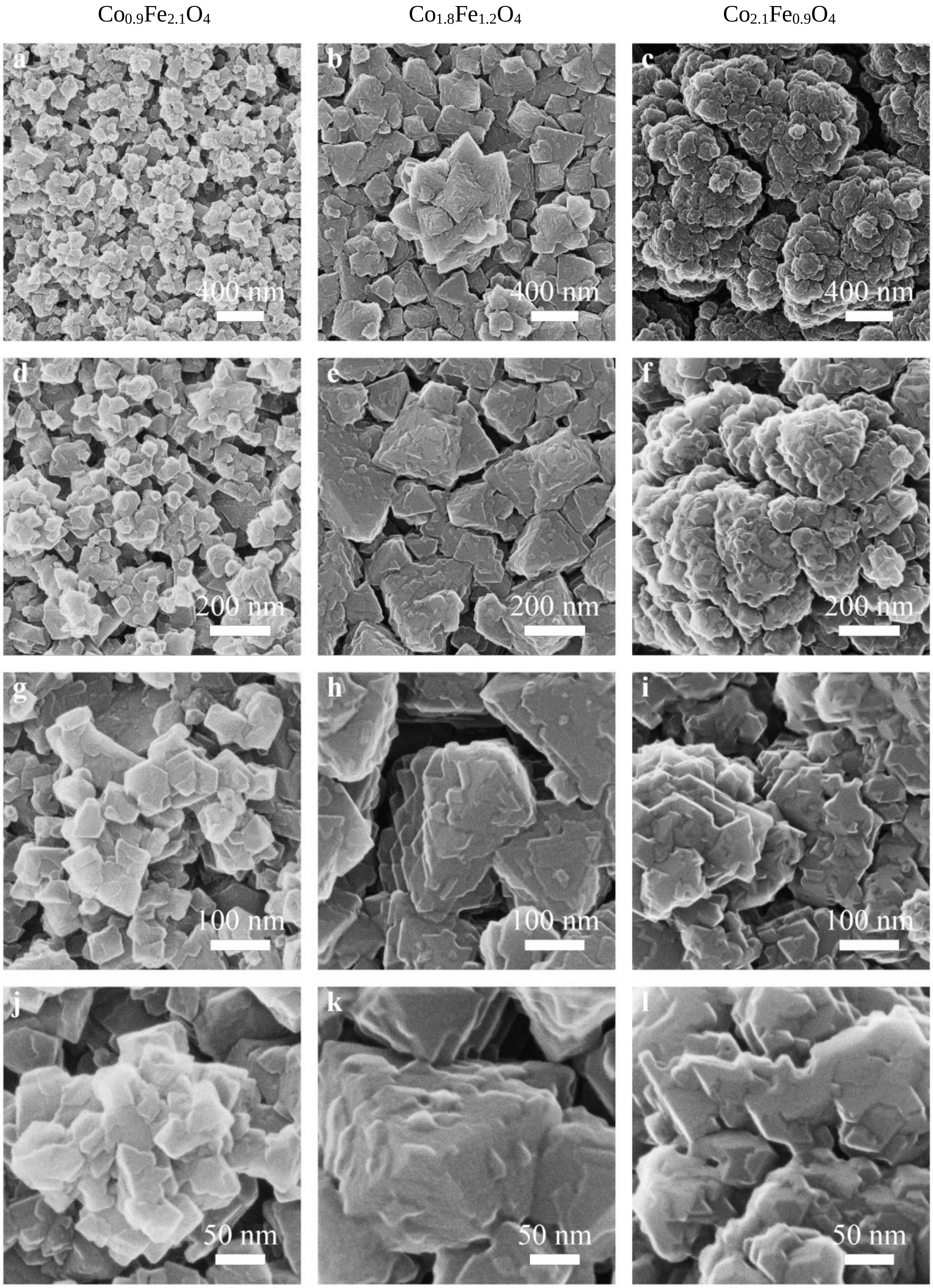

Fig ESI 3 Additional HIM micrographs.