Structural and Microstructural Characterisation of Pd-Au/C catalyst by Anomalous Wide Angle X-ray Scattering

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Introduction

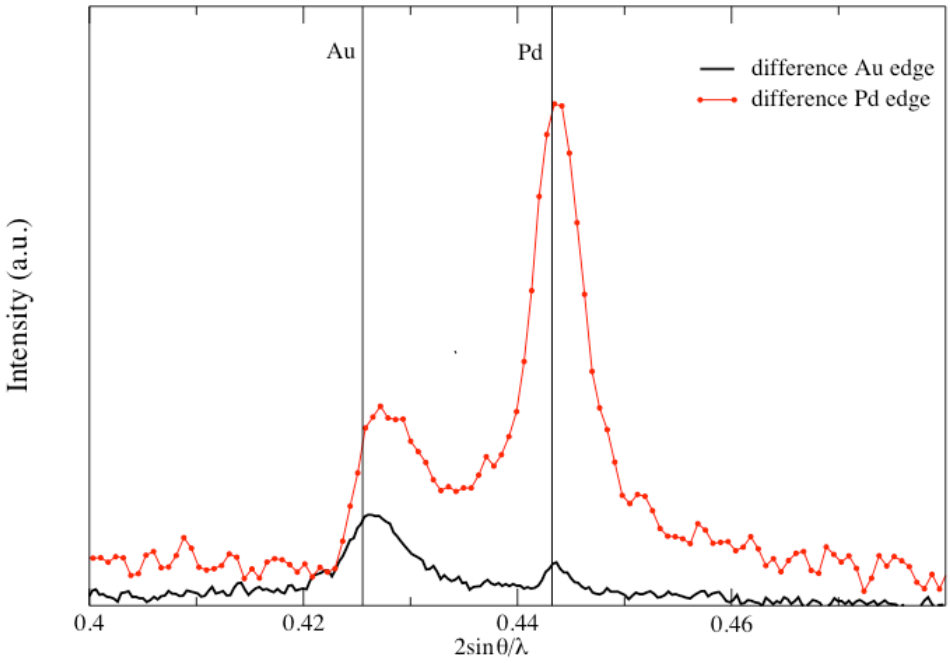
The fully understanding of a bimetallic catalyst requires a deep characterization of its structure at micrometer, nanometre and atomic scale. In particular the knowledge of the crystallographic nature of the formed phases is a key issue.
Bimetallic catalysts are very interesting and promising systems, since they allow better chemical selectivity/activity and higher resistance to aging and/or poisoning process. Alloying processes significantly alter the chemistry of the involved metals and these changes are related to the nature of the final compounds. The synthesis processes significantly affect the catalytic and, in general, the physical properties of the final compounds. The main aim of this work is to investigate in situ the crystallographic composition of Pd-Au catalyst supported on carbon.
The nano-sized nature of catalyst particles (size less than 2-3 nm), phase separation and/or the formation of metastable phases reduce the contrast using SEM, TEM and XRD. The Anomalous-XRD (A-XRD) technique allows improving the chemical selectivity of diffraction techniques and offers a valid possibility to distinguish the chemical nature of the crystallographic phases in the catalyst

Experiment

XRD patterns have been collected at GILDA beamline using an IP as detector [1] and a reaction chamber specifically designed to control the gas flowing through the sample during (the gas flowing was necessary to prevent the Pd present in the sample from oxidation).
XRD patterns were collected below (I_{E2}) and at (I_{E1}) the Au L_I edge (Pd K edge).

Results

The difference patterns (fig) $\Delta E=I_{E2}-I_{E1}$, reveal the crystallographic nature of Au- (Pd-) containing phases, and suggesting a decorating effect of Au on Pd particles. See figure.



Reference

[1] Meneghini C. et al. J. Synchrotron Rad. 8, 1162 (2001).

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