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Electrochemistry in the Light of *In Situ* Bragg Coherent Diffraction Imaging

C. Atlan^{1,2,3}, C. Chatelier^{1,2}, A. Viola³, K. Olson³, M. Grimes^{1,2}, M. Dupraz^{1,2}, I. Martens², L. Gao⁴, S. J. Leake², T. Schüllli², J. Eymery¹, F. Maillard³, M.-I. Richard^{1,2}

¹Univ. Grenoble Alpes, CEA Grenoble, IRIG, MEM, NRX, 17 avenue des Martyrs, 38000 Grenoble, France.

²ESRF - The European Synchrotron, 71 Avenue des Martyrs, 38000 Grenoble, France.

³Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, Grenoble INP, LEPMI, 38000 Grenoble, France.

⁴Laboratory for Inorganic Materials and Catalysis, Department of Chemical Engineering and Chemistry, Eindhoven University of Technology, P. O. Box 513, 5600 MB Eindhoven, The Netherlands.

mrichard@esrf.fr

The advent of the new 4th generation x-ray light sources represents an unprecedented opportunity to conduct *in situ* and *operando* studies on the structure of nanoparticles in reactive liquid environments.

In this poster, we will illustrate how Bragg coherent x-ray imaging [1] allows to image in three dimensions (3D) and at the nanoscale the strain and defect dynamics inside nanoparticles during an electrochemical reaction or a phase transformation. First, we successfully imaged the morphology, the lattice displacement and the strain of a Pt nanoparticle in electrochemical environment (see Figure 1) [2]. Secondly, we will show how Bragg coherent x-ray imaging allows to study the structural evolution of single Pd nanocrystals during H₂ absorption and desorption. Open questions remain regarding the maximal quantity of H that can be inserted into a Pd nanocrystallite, the mechanism and kinetics of hydride (PdH_x) nucleation (preferential sites for nucleation or homogeneous nucleation at the whole particle surface) and growth (α/β sharp transition or two-phase coexistence).

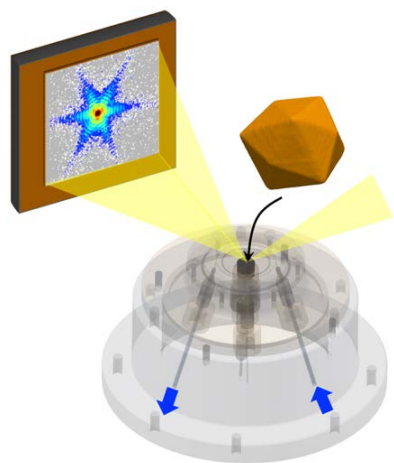


Figure 1. Scheme of the experimental setup of the *in situ* Bragg coherent x-ray imaging experiment. The electrochemical cell, a reconstructed image of the Pt particle as well as a detector image are displayed.

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- [1] I. Robinson and R. Harder, *Coherent X-Ray Diffraction Imaging of Strain at the Nanoscale*, Nat. Mater. **8**, 291 (2009).
- [2] C. Atlan *et al.*, *Imaging the strain evolution of a platinum nanoparticle under electrochemical control*, Nat. Mater. accepted (2023).