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## Breathing Pt nanoparticle imaged using in situ BCDI

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## Breathing Pt nanoparticle imaged using *in situ* BCDI

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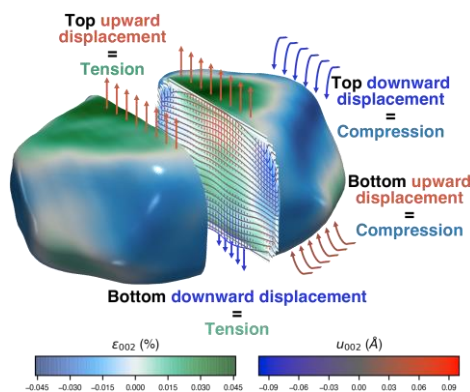
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The relationship between surface strain and the rate of a (electro-)catalytic reaction was unveiled by Hammer and Nørskov using density functional theory (DFT) calculations<sup>[1,2]</sup>. They proposed that the rate of the sluggish oxygen reduction reaction (ORR) would be enhanced on Pt-based catalysts binding \*OH species *ca.* 0.10 - 0.15 eV more weakly than Pt(111),<sup>[1,2]</sup> later experimentally verified using a Pt<sub>3</sub>Ni(111)-skin surface.<sup>[3]</sup> Nevertheless these predictions did not translate to Pt-based nanocatalysts, in part because these feature present multiple catalytic sites with a range of binding energies. Also, DFT calculations consider catalytic surfaces in vacuum, *i.e.* in the absence of water molecules and electric field. Hence, an *in situ* picture of how strain is distributed on Pt-based surfaces is still lacking.

In this contribution, we took benefit of recent advances in Bragg Coherent Diffraction Imaging (BCDI)<sup>[4,5]</sup> and of the fourth generation Extremely Brilliant Source of the European Synchrotron (ESRF-EBS, Grenoble, France) to map strain over Pt nanoparticles in electrochemical environment. Our results reveal that strain is heterogeneously distributed between highly- and weakly-coordinated surface atoms, and propagates from the surface to the bulk of the Pt nanoparticle as (bi)sulphates anions adsorb on the surface.



**Figure 1:** Representation of the strain distribution observed on a Pt nanoparticle under potential control. 0.05 M H<sub>2</sub>SO<sub>4</sub>.

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