

# Abstract



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## In situ study of Fe nanoparticles in H<sub>2</sub> atmosphere: surface reconstruction and reactivity

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Fe nanoparticles (FeNPs) can serve as valuable starting materials for synthesizing nanostructured Fe nitrides<sup>1</sup> and iron carbides<sup>2</sup>, or for acting as catalysts<sup>3</sup>. The optimization of their morphology, and especially of their surface, in terms of exposed facets as well as chemical composition is thus crucial for enhancing their reactivity. Notably, due to their high sensitivity to air, FeNPs are often coated with oxide layers. Reducing these oxide shells is essential in view of the above. In this work, we monitor in situ iron oxide reduction at the surface of ligand-coated spherical FeNPs synthesized via a chemical process<sup>4</sup>, presenting a cubic body-centered cubic (bcc) structure, ranging in size from 10 to 15 nm. We focus primarily on the surface activation process under H<sub>2</sub>, where ligands detach from the nanoparticle surface (Fig.1), and the oxide shell eventually present is reduced. To capture and analyze these transformations, we employed environmental aberration-corrected scanning transmission electron microscopy (STEM), enabling the in situ observation of the surface, structural, and morphological evolutions of these NPs down to the atomic scale.

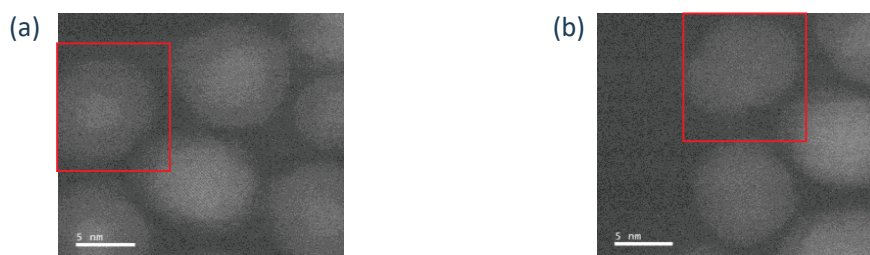


Figure 1: (a) is start and (b) is the end of plateau, under H<sub>2</sub> at 1 atm and 300°C.

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