

Title: Real-Time Observation of MgO Dissolution: An *In Situ* TEM Study

Keywords: nanopowders, synthesis, morphology, crystal structure, phase transformation, dissolution.

Scientific description: Reactions at liquid–solid interfaces are critical in geological processes and catalytic reactions, particularly those involving hydrogenation and dehydrogenation. The transformation of magnesium oxide (MgO) into brucite ($\text{Mg}(\text{OH})_2$) provides an excellent model system for studying dissolution phenomena.

Previous work on MgO nanopowders (Baumann et al., Langmuir 2015, 31, 2770.) demonstrated that particle size strongly influences dissolution behaviour. In particular, sufficiently large particles form protective surface layers that delay or inhibit dissolution. Furthermore, large MgO cubes (>100 nm) exhibit dissolution-dependent shape transformations, with the (100), (110), and (111) planes progressively emerging as dissolution slows.

The proposed M2 thesis will investigate, in situ, the dissolution of MgO smoke nanoparticles. MgO powders will be synthesized via metal combustion in a glove box, then exposed to small quantities of liquid water. In collaboration with colleagues at IJCLab (Paris-Saclay University), dissolution will be monitored in real time using transmission electron microscopy. Experimental observations will be complemented by Density Functional Theory (DFT) simulations, and a parallel theoretical Master thesis may also be envisaged.

This research seeks to advance our understanding of liquid–solid interface reactions, with implications for geology, catalysis, and materials science.

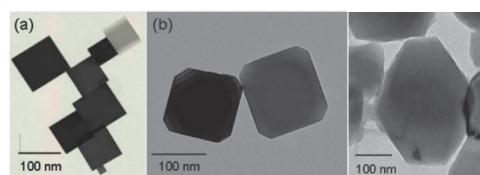
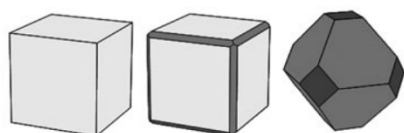


Figure: Transformation of MgO particles upon their progressive dissolution in water (pH = 6.8). Adapted from *Phys. Chem. Chem. Phys.*, **2009**, 11, 2228.



Techniques/methods in use: synthesis via physical method (evaporation based, metal combustion), in situ TEM.

Applicant skills: any experience with the indicated experimental techniques will be considered as an advantage.

Industrial partnership: No (specify the company)

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Internship location: 4, place Jussieu 75252 Cedex05 Paris. The tower 22, hall 22-12, 5th floor.

Possibility for a Doctoral thesis: can be foreseen (specify if already financed).