

***In-Situ* TEM liquid flow cell synthesis of nanoparticles**

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In the last decades, characterisation of natural and man-made materials by means of electron microscopy became one of the basic investigation techniques. The fast development of the investigation methods and accessibility of the scientific equipment, combined by the introduction of novel research techniques, further unlocks our insight down to the atomic level. However, besides beautiful pictures, the data obtained from such investigations can be crucial in the experiment planning and design, for fine-tuning or adjusting the synthesis itself, for modification or tailoring of nanoparticles and nano-structures for various applications in sensors, catalysis, magnetism, etc. Conventionally, we are able to observe our samples only *post-mortem*; after the synthesis

or after the treatment, but the tendency to observe the reactions, nanoparticle nucleation or performance of catalyst *in-operando* is probably as old as the invention of the electron microscope itself. The implementation of thin membranes to confine hydrated or gaseous samples exposed to the high vacuum of the electron microscope chamber is not new but has recently experienced a new Renaissance. In the talk, some of the fundamentals and limitations of the liquid-flow *in-situ* synthesis and characterisation using transmission electron microscope will be presented, together with recent advances on the synthesis of anisotropic gold nanoparticles.

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