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Liquid phase synthesis of materials - nanostructures and characterization

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The liquid phase synthesis of materials is a powerful way to obtain samples which could otherwise not be prepared by conventional methods. This is particularly useful when dealing with nanomaterials, as starting from metal organic precursors favors a better control of the nucleation/growth phenomena.

In this work, the synthesis of nanoparticles of metal oxide compositions was performed using non-hydrolytic solvothermal synthesis in the ZrO_2 , ZnO , SnO_2 and TiO_2 systems. The objective was to obtain crystallized particles with uniform sizes of less than 5 nm to correlate the synthesis parameters, size and local structure of the samples. Indeed, for such small sizes, the bulk-based structural models do not apply anymore and specific properties are identified.

For all the selected chemical systems, the synthesis of very small crystallized particles was successful. In this case, the control of water and thermal parameters is as important as the choice of the reagents. The samples were analyzed by conventional X-ray diffraction, pair distribution function and transmission electron microscopy in order to determine their average and local structure as well as their morphology. Locally, the atomic structure of the particles are clearly different from the bulk structures when the sizes are inferior to 5 nm.