Fabrication of nanostructured zirconia powders by spray pyrolysis for energy and biodomain. Structural and microstructural characterizations.

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Zirconium oxide is a remarkable material due to its mechanical and electrical properties dependent on the crystalline phases and structural phase changes, which are described by the temperature-composition phase diagram and grain size. Yttria-stabilized zirconia (YSZ) is the common electrolyte in solid oxide fuel cells (SOFC) operating at high temperature and can be used in dental and femoral prosthesis. In recent years, there has been an increasing interest in ultra-fine grained ceramics studying the physical properties with respect to different microstructures, mainly due to the decisive role played by the increased number of grain boundaries in the total conductivity of the stabilized zirconia.

The aim of this practical work is first to synthesize nanostructured ZrO_2-Y_2O_3 polycrystalline powders using the spray-pyrolysis technique using an ultrasonic atomizer of 1.3MHz starting from a precursor solution (1/2 day).
The second part will be focused on the structural and microstructural characterizations of these powders in relationships with the commercial one. XRD and SEM observations will be performed. Purity and control of crystallite size and particle size will be discussed. Raman spectroscopy and XRD will be compared in the discrimination of tetragonal and cubic phases in the particular case of nanometric powders. The effect of Y_2O_3 doping will be developed in terms of phase transitions (cubic, tetragonal, monoclinic phases) versus grain size (1/2 day).

It will be based at Phelma Campus-Grenoble INP.
Studies level requested to follow this practical: Master in Materials Science or in Chemistry.

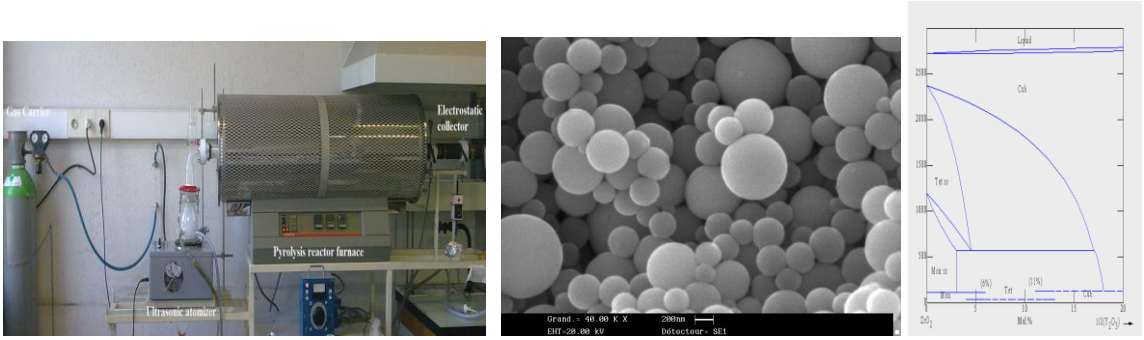

Figure 1: a) Spray-pyrolysis set-up. b) SEM images of YSZ powders. c) ZrO_2-Y_2O_3 phase diagram.

References

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