N°39: Nanostructured zirconia powders by spray pyrolysis for clean energy: fabrication, structural and microstructural characterizations

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INTRODUCTION

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. 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.

OBJECTIVES

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 (Fig. 1).

The second part will be focused on the structural and microstructural characterizations of these powders in relationships with the commercial ones. 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 nanostructured powders. The effect of Y_2O_3 doping will be developed in terms of phase transitions (cubic, tetragonal, monoclinic phases) versus grain size.

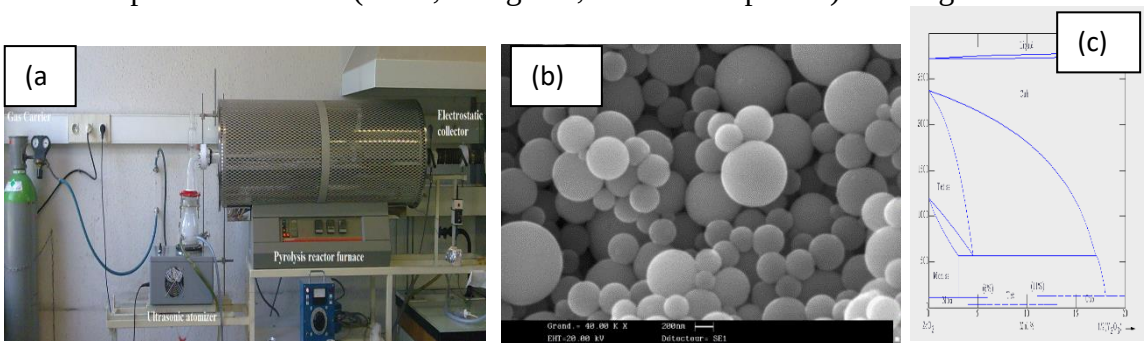

Fig. 1: a) Spray-pyrolysis set-up. b) SEM image of YSZ powders. c) ZrO_2-$YO_{1.5}$ phase diagram.

References

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