Hydrothermal synthesis of nanostructured inorganic powders by a continuous process under supercritical condition… (Fe_2CoO_4, TiO_2 and $BaZrO_3$)

N. MILLOT, D. AYMES, B. XIN, C. PIGHINI, J.C. NIEPCE

LRRS, UMR 5613 CNRS/Université de Bourgogne,
BP 47870, 21078 DIJON Cedex, France
nmillot@u-bourgogne.fr

Nanostructured ceramic materials for electronic or electrotechnic applications draw industry and scientist attention because of their physical properties depending on grain size [1]. Since surface energy allows stabilizing highly symmetrical phases apart from the usual limits, new materials can be obtained [2]. Synthesis methods of nanometric powders, in particular continuous synthesis technologies (allowing several ten or hundred grams per hour production) are then very interesting.

In this study, using a prototype of hydrothermal synthesis in subcritical and supercritical water working in a continuous way, nanometric ceramic precursors with perfectly defined composition are produced: spinel ferrites such Fe_2CoO_4, TiO_2 with anatase structure and also perovskite structures such as $BaZrO_3$. The as-prepared powders are fully characterized by complementary experiments: X-ray diffraction, electron microscopies, EDX spectrometry, surface area measurement... Thus, particles size, morphology, aggregation state, crystal structure, composition are investigated. Moreover, magnetic properties of the ferrites products are studied. The powders obtained are pure phases very well crystallized in a nanometric range.

Our technology has the main advantages to be easy to use compared to closed reactors and to have a high productivity. It opens news insights into the decrease of the sintering temperature of such interesting ceramic product.

[1] R.W. Siegel, E. Hu, D.M. Cox, H. Goronkin, L. Jelinski, C.C. Koch, M.C. Roco, D.T. Shaw, WTEC Panel Report on nanostructure Science and Technology, edited by International Technology Research Institute (1998).
[2] N. Millot, D. Aymes, F. Bernard, J.C. Niepce, A. Traverse, F. Bourée, B.L. Cheng, P. Perriat, *J. Phys. Chem. B* **107**, 5751 (2003).