Charmmmat

Postdoctoral Position

"High entropy oxides"

Context

High Entropy Oxides (HEOx) constitute a new class of materials that has been discovered in 2015 (C. M. Rost , Nature Comm. 2015, 8485). When mixing several constituents at high temperature, the contribution of the entropy of configuration in the Gibbs free energy becomes preponderant, and a single-phase material is obtained with a random distribution of the elements, which can be stabilized at room temperature by quenching. This is typically the case of the canonical composition (MgCoNiCuZn)O, obtained by heating a mixture of the binary constituents above 875°C, which leads to a rocksalt structure with a random distribution of the cations on the cationic FCC sublattice. Therefore, HEOx are not only new materials, they constitute a new paradigm in the development of new functional materials with tuned properties.

Since the discovery of these materials, our team in ICMMO - Univ. Paris-Sud, Orsay, has shown that many chemical substitutions can be performed on the cationic site of these compounds, which enables a huge versatility of the materials composition. Besides, we have shown that upon appropriate substitutions, these materials exhibit colossal dielectric constant, and/or superionic Li+ conduction, which makes them appealing for applications in supercapacitors or solid state batteries. (D. Berardan et al., J. Mat Chem A 2016, 9536-9541; Phys Stat Sol RRL 2016, 328)

Project

To date, HEOx compounds are synthesized by annealing a mixture of the constituting elements at high temperature followed by quenching. The main objective of this project is the development of new synthesis routes using "chimie douce" methods (coprecipitation, Pechini, …) instead of solid state chemistry, in order to:

- expand the composition range of the materials to new compositions or stoichiometries that can not be obtained by synthesis at high temperature

- control the micro/nanostructure of the materials, which is a key parameter towards the optimization of the dielectric properties or the ionic conductivity.

In addition, physical properties of the synthesized materials will be performed and compared with samples obtained by standard high-temperature methods and quenching.

This project will be performed within a collaboration between LPMC - Ecole Polytechnique (synthesis by wet-chemical routes) and ICMMO - Univ. Paris-Sud (characterization of the functional properties) and supported by the Charmmmat Consortium.

Candidate and position

The candidate should hold a PhD in chemistry, material science or solid state chemistry, with a good experience in the synthesis of oxide materials using soft chemistry routes, as well as their characterization using XRD and electron microscopy. A previous experience with any of the functional properties relevant to this system (dielectric properties, ionic transport, magnetism, optical properties, …) would be appreciated.

Good english communication skills are required.

This position is funded for one year and the standard salary, after tax and social insurance, is 2150 euros per month and commensurate with experience.

The applicant should have less than two year experience after PhD. The evaluation of the candidates will start immediately, the position will remain open until filled.

Application, as a single PDF file, should include a motivation letter, CV, list of publications and the names/contact details of at least two referees, and submit it to :

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