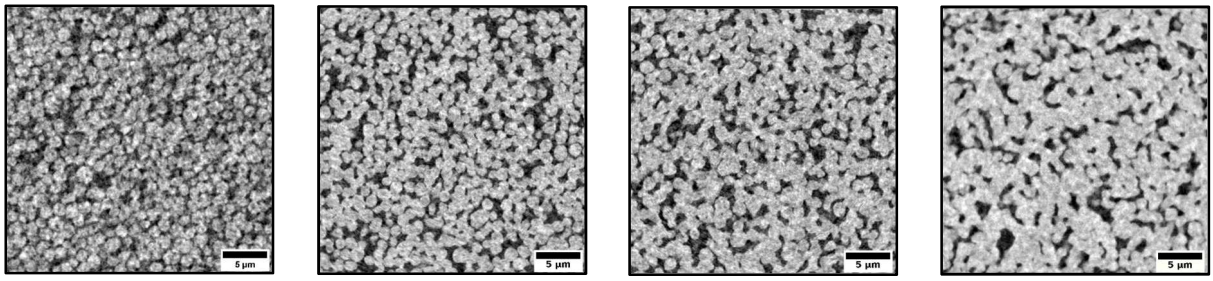
Internship position - M2 / PFE

In-situ synchrotron nano-tomography sintering of ceramic powders

Proposition of internship work at Laboratoire SIMAP, Univ. Grenoble Alpes, France

Scientific Background and Context:

3D imaging in the course of sintering has proven to be highly valuable for improving the understanding of sintering of metallic and glass powders. Owing to the unique characteristics of ceramic particles (micron-size or smaller, and irregular form), a significantly higher resolution is necessary. This is now feasible with the upgradation of the European Synchrotron Radiation Facility (ESRF) in terms of the resolutions and the scan times. The proposing group has recently successfully conducted in-situ nano-tomography experiments to obtain a series of images in the course of sintering of a model ceramic powder (spherical micro-sized alumina powder) with a high resolution of 25 nm at 1500°C (Fig. 1). In order to further expand the scope of this research, it will be relevant to analyse a more complex type of ceramic powder, increasingly used, which comprises of particles with a size of a few hundreds of nanometres. Due to their small size, these particles naturally or artificially agglomerate. Consequently, at the beginning of sintering, the powder compacts usually exhibit inter-agglomerate pores of micron-size. These pores contribute to non-uniform compact density, thus hindering complete densification of the compact and forming defects in the final material. Understanding the changes of these pores during sintering is therefore a crucial task.



(a) (b) (c) (d)

Figure 1: Slices of the 3D reconstructed alumina samples (a) sintered at 1500°C and observed after (b) 1 hour, (c) 5 hours and (d) 10 hours

Main objectives:

- to obtain full 3D nano-tomography (nCT) images in the course of sintering of agglomerated submicron zinc oxide powder compacts that exhibit inter-agglomerate pores, through in-situ X-ray nano-tomography
- to provide quantitative insights into the sintering phenomena
- to explore the development of the pores and the resulting differential densification during the entire sintering cycle

Key Highlights:

- The proposing group has proven expertise on in-situ nano-tomography acquisition and analysis
- Beamtime at ESRF on the nano-tomography beamline ID16B has been granted and is scheduled for mid-March 2022, offering a unique opportunity to participate in the in-situ observations at a large-scale instrumental set-up.
- Exposure to performing X-ray nano-tomography experiments at the ID16 high resolution beamline and for the subsequent image reconstructions
- Close collaboration with a PhD research in the framework of MATHEGRAM - an Innovative Training Network, funded by the EU

Requirements - Skills/ Qualifications:

- Background in material science or a closely related discipline
- Interested in experimental research activities, including numerical data processing
- Solid basic knowledge in programming languages like Python or comparable
- Sound knowledge of image processing and segmentation methodologies
- Effective communication and team-working skills

The internship is planned for a start from February 2022 for a period of about 6 months

Internship allowance:

About 570 € per month

Contacts/ Selection process:

Candidates can send their applications to:

Didier BOUVARD (didier.bouvard@grenoble-inp.fr)
Pierre LHUISSIER (pierre.lhuissier@simap.grenoble-inp.fr)
Aatreya VENKATESH (aatreya.venkatesh@simap.grenoble-inp.fr)

European synchrotron facility at Grenoble

Univ. Grenoble Alpes campus