

Chemo-hydro-mechanical response of cement paste carbonation through coupled X-ray and neutron high resolution imaging and modelling in recycled concrete aggregates

Reference: [InnovaXN_31_2019_ESRF](#) or [ILL1](#)**CONTEXT & JOB DESCRIPTION**

The aim of the PhD project is to bring local and quantitative experimental evidence about the spatial and temporal evolution of saturation and density profiles during cement paste carbonation. With the aim of reducing building constructions environmental footprint, novel processing methods of recycled concrete aggregates are characterized by CO₂ uptake reactions, while ensuring long-term mechanical and durability properties of second generation concretes.

This promising new technology is nonetheless in need of experimental investigations, which are so far limited to macroscopic measurements. Neutron and X-ray imaging lend themselves as ideal probes for capturing and understanding the involved mechanisms. The expected outcome consists in the development of chemo-hydric models (analytical or Finite Element ones) essential to the understanding and ensuring optimization of the process. This first step is pivotal in the ongoing effort to reach the carbon neutrality of concrete production.

The successful candidate will join D50/ID19's team at the ILL/ESRF. Beamlines D50 and ID19 allow performing Neutron and X-rays imaging.

Further information may be obtained from Matthieu Briffaut (UGA) (matthieu.briffaut@3sr-grenoble.fr).

PROFILE, SKILLS AND EXPERIENCE

- Degree allowing enrollment for a PhD (such as MSc, Master 2 de Recherche, Laurea or equivalent) in Civil engineering, materials science, or closely related science
- A background in experimentation is desirable, and knowledge of cement chemistry and scientific imaging would be an advantage
- Manual skills and rigorous attention to detail are essential in this work environment.
- Proficiency in English (A proof of upper-intermediate level must be included in the application. Applicants originating from native-English-speaking countries can apply without the need for proof of level. An official degree conducted in English will be also accepted as a proof). French speaking can also be useful for everyday life but is not a necessity.
- Compliance with the Marie Skłodowska-Curie mobility rule: candidates may not have resided or carried out their main activity (work, studies, etc.) in France for more than twelve months in the three years immediately before the date of recruitment.
- At the date of recruitment, early-stage researchers must be in the first four years of their research careers and have not yet been awarded a doctoral degree.
- Candidates must satisfy the conditions for enrollment in a doctoral programme

More details about the application procedure on www.innovaxn.eu/for-students/documents/

WORKING CONDITIONS

The successful candidate will be enrolled in the doctoral school of (University Grenoble Alpes) and based full-time at the ESRF and/or ILL (Grenoble, France), other than a 3-month secondment at Lafarge/Holcim (Saint Quentin Fallavier near Lyon). Furthermore, a varied pedagogical training programme will be offered to the successful candidate throughout the 3-year PhD project.

More details on the InnovaXN programme on www.innovaxn.eu

InnovaXN is a Horizon 2020 MSCA COFUND programme providing an opportunity for 40 industrial companies to work with 40 PhD students, performing advanced research and exploiting the unique characterisation techniques of the ESRF and ILL. Through collaborations with industry, innovation will be the central theme of the programme. This will provide a unique cross academic-industry science setting, secondment opportunities and society-relevant research, training the future key researchers able to tackle major research and societal challenges.

