A fully funded **4 years PhD scholarship** is available, **starting in June-Sept 2021**, on

Colloidal and interfacial properties of calcined clays for greener cementitious materials

Location: INTERFACES Dpt, ICB, UMR 6303 CNRS, Univ. Bourgogne Franche-Comté, FR-21000 DIJON, FRANCE

Context: Concrete, obtained by mixing cement, gravel and water, is the most widely used material in the world thanks to its excellent mechanical performance and low cost. However, the production of cement clinker is responsible to about 7-10 % of the anthropic CO_2 emissions which for obvious reasons need to be reduced. In this scope, one of the most promising and pragmatic route consists in substituting cement clinker with a large amount of reactive calcined clay and limestone. During the last decade, a considerable research effort has been devoted to these promising cements containing calcined clays and limestone (C2L cements) accompanied with a growing industrial interest. There are, however, still several limitations to overcome before C2L cements become a reality. The two major limitations are their poor rheological behavior and slow development of mechanical performance at early age. The present PhD project is part of a larger research consortium project aimed at addressing these limitations from both a fundamental and practical perspective. The research consortium gathers 5 research leading groups in cement and concrete science (DTU Danemark, IIT Delhi India, Aahren University Germany, UCLV Cuba, Bourgogne University), involves 7 closely linked PhD projects and is financed by the global research network Innovandi (https://gccassociation.org/innovandi/).

Project: The proposed PhD project aims at deciphering the interfacial and colloidal properties of calcined clays, that is charge formation, surface chemistry, ion adsorption and dispersion structure; known to be key parameters for the control of their rheological behavior. The work will start with a detailed characterization and modelisation of the charge formation and ion adsorption of calcined clays. This will be achieved with a combination of potentiometric titration, electrophoreris and adsorption isotherm measurements supplemented with X-Ray photoemission spectroscopy on pure model clay systems in various controlled conditions (calcination temperature, solution composition, particle volume fraction). The work will then be complemented with a study of the stability and aggregate structure of the calcined clays in diluted and semi diluted conditions. This last part of the work will involved static and dynamic light scattering. Small X-ray scattering may also be used.

Environment: The successful candidate will have a direct access to a fully equipped analytical chemistry and nano-characterization laboratory. She/he will also benefit from an assistant engineer in analytical chemistry and one research engineer for the XPS experiments and analysis. The research consortium project will further provide a unique and fruitful collaborative environment.

Supervision: Christophe Labbez (CR CNRS) and Bruno Domenichini (Pr UBFC)

Application: To apply, please email a note of interest, 2 letters of recommendation, your CV to christophe.labbez@u-bourgogne.fr

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