

Impact of physico-chemical properties of raw materials on mechanical performance in relation to the durability of low carbon concrete

CONTEXT

Nowadays, Ordinary Portland Cement (OPC) production is responsible for 5 - 10% of man-made CO₂ footprint and this value is expected to keep increasing if solutions are not quickly adopted.

One of the most effective strategies to reduce the environmental impact of concrete is to replace OPC with Supplementary Cementitious Materials (SCMs). Among the several types of binders developed in the last decades, Limestone Calcined Clay Cements (LC3) are some of the most promising in terms of sustainability, performance and overall, expected worldwide availability.

THESIS WORK DESCRIPTION

Within the framework of the collaboration between EPFL, one of the most prestigious science and technology institutions in Europe, and Vinci Construction, a global leader in construction with over 1.300 companies and 115.000 employees, this PhD work aims to reduce the carbon emission related to construction industry with a significant impact on the world's environment.







New sources will be employed for optimising the synergy between the various compounds in the development of powerful innovative binding matrices. This work will implement a multi-scale and multi-technique approach for studying in detail the characteristics of the cementitious phases in the presence of these SCMs, assessing their reactivity but also making the link with their microstructural properties, their mechanical behaviour, as well as the study of concrete durability. The final objective is to predict a minimum service life to control the corrosion risk of each formulation, coupling laboratory experiments with scaled-up in-situ tests. The scientific data and knowledge developed during this thesis work will ultimately be used to support the modification of the current regulation.

PROFIL REQUIRED

The candidate should have an engineer's or master's degree in one of the following disciplines: materials chemistry, physical chemistry of materials or materials science. A strong background in materials properties analysis and a strong interest in experimentation are required. A first experience in concrete formulation or in the road sector would be appreciated.

The candidate will be able to demonstrate autonomy and initiative, and a strong aptitude for organisation, responsibility, and adaptability. Communication skills and curiosity are also required.

Fluency in English, both written and spoken, is essential to broaden the scope of the work through international publications.

	CDD Doctoral student/Doctoral contract		From March 2023		48 months
	Ecole Polytechnique Fédérale de Lausanne + Research Center Vinci Construction in Mérignac		CV + covering letter + transcripts from master and/or engineering school + letter of recommendation from the M2 internship supervisor		Romain LAFON, Head of Aggregates and Concrete section romain.lafon@vinci-construction.com Valentina MUSUMECI, Research engineer valentina.musumeci@vinci-construction.com Karen Scrivener, Full Professor EPFL karen.scrivener@epfl.ch