

The faculty of Engineering of the Vrije Universiteit Brussel and the Graduate School in Ecole Polytechnique de Bruxelles of the Université Libre de Bruxelles invite you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES (VUB)

DOCTORAT EN SCIENCES DE L'INGENIEUR ET TECHNOLOGIE (ULB)

of **Maïté Lacante**

The public defense will take place on **Tuesday 14th October 2025 at 6:15 pm** in room **I.2.03** (Building I, VUB Main Campus)

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VOLUME CHANGES OF ALKALI-ACTIVATED MATERIALS IN SEALED CONDITIONS

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Abstract of the PhD research

Concrete is the most widely used construction material in the world. Unfortunately, the production of its essential ingredient, Portland cement, is responsible for 5% to 7% of global anthropogenic CO₂ emissions. To reduce this percentage, clinker-free alternative binders with a low associated CO₂ footprint, such as alkali-activated materials, are emerging as a promising and necessary alternative to ordinary Portland binders. While researchers have already tested and studied some of their mechanical properties, alkali-activated materials suffer from significant early-age volume changes, such as autogenous and thermal deformation, with limited studies on the coefficient of thermal expansion. These high early-age volume changes can lead to cracking and structural instability if not properly handled.

In this PhD thesis, the objective is to study the impact of various factors on the volume changes of alkali-activated materials, with a focus on their autogenous and thermal strain. Factors such as the amount of solution, activator type, concentration, and temperature conditions as well as internal relative humidity have an important influence on how the early-age volume develops. The mitigation effect of limestone filler, metakaolin, and curing temperature will be investigated as well. To address the issue of cracking, the cracking behaviour of these materials will be studied with acoustic emissions.

Overall, this research aims to contribute to the development of clinker-free alternative binders that have lower CO₂ emissions and are suitable for use in the construction sector.