

**Use of French Polynesia Pinctada pearl oyster shells for
environmental-friendly concrete
(Pinctada project)**

PINCTADA research project presentation

PINCTADA intends to answer to new Energy and Environment challenges by increasing performance and reducing environmental cost of cementitious materials based on seashell incorporation with direct application in French Polynesia construction.

French Polynesia is well known for its production of Tahitian culture pearl from *Pinctada margaritifera* nacre. Careful management of the nacre stock and the environment in which it is raised, as well as a measured response to changing economic factors are necessary to maintain a sustainable industry. Particularly, natural farming of *Pinctada margaritifera* is submitted to the competition of the smaller natural specie *Pinctada maculate*, which exists in larger numbers than the margaritifera variety around the Polynesian islands and atolls.

This important nacre production generates an important amount of seashell under-product wastes for both *Pinctada margaritifera* and *Pinctada maculata* for which the re-use in industry has only few applications (cosmetic, jewellery, marquetry and local handicraft). In the same time, there is almost no production capacity of local quarries for construction aggregate supply especially in coral reef atolls and the exploitation of distant quarries increases the global environmental cost of the concrete used locally. Therefore a first objective of the PINCTADA project is to propose a new formulation of environmental-friendly concretes where the classical mineral granular skeleton is replaced by nacre seashell produced locally while ensuring similar durability and mechanical performances compared to classical and normalized concrete formulations.

In addition, nacre – the iridescent material in seashells – is one of many natural materials employing hierarchical structures to achieve high mechanical performance from relatively weak constituents. Nacre has bio-inspired and motivated many researchers in the last ten years to understand, mimic and transfer to synthetic materials its unique mechanical performance. The second objective of the PINCTADA project is hence to improve the performance of cementitious material by proposing new formulation of nacre-based fiber-reinforced concrete.

Partners

- *E2S Newpores project* (an international hub for the mechanics and physics of porous materials)
- *Direction des Ressources Marines de Polynésie Française* (local authorities for sea resource management)
- *Délégation à la Recherche de la Polynésie française* (local authorities for research and innovation)

PhD candidate objectives

Within the PINCTADA project, the PhD candidate will be in charge of the material formulation and the performance validation of new environmental-friendly and high-performance concrete materials incorporating local nacre seashell under-products for application in French Polynesia construction. The PhD candidate will be involved at each step of the project, starting from the nacre seashell-based granular skeleton optimization, the global environmental cost estimation, to the material performance characterization both in laboratory and on-site. He/she will exchange directly with all the partners and local authorities involved within the project.

Candidate's profile

The candidate should hold a master degree in civil or mechanical engineering, physics, materials science or a similar field. Previous experience with the characterization of porous media (transport, elasticity, failure), the optimisation and casting of cementitious materials, or the development of custom-made experimental set-ups is an asset as well as a good knowledge of the culture, the resources and the construction techniques of French Polynesia. The candidate should have a strong interest in performing experimental work in a multi-disciplinary team. Proficiency in English is mandatory for both oral and writing communication.

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Job details

The successful candidate will be hosted at ISABTP Civil Engineering School by LFCR (UMR5150, UPPA-CNRS-Total SA) laboratory. Prof. David Grégoire will direct the project and supervised the PhD student.

The envisioned starting date is October 1st, 2021, and the maximum duration is 3 years. The maximum duration of the PhD is 3 years and the position includes full social security coverage and a gross salary of approx. 1878 € per month. This salary encompasses 16h of teaching hours at E2S UPPA/ISABTP per year.

Evaluation procedure

Candidates will be ranked in a first phase based on their submitted application.

In a second phase, an interview will be organized with the selected candidates (possibly via Skype).

Applications should include a cover letter, CV, passport/ID copy, transcripts of diplomas and lists of courses attended (with grades obtained), recommendation letters, and names and contact details of at least two references.

Applications should be submitted before 01/05/2021 at www.davidgregoire.fr/opening-positions

The interview will take place during the second half of May.

Final answer will be provided by the end of May.

Contact

For further information about this position, please contact Pr. David Grégoire ([david.gregoire\[at\]univ-pau.fr](mailto:david.gregoire[at]univ-pau.fr)).