

POSTDOCTORAL POSITION

Title

Multiphysics modelling of bio-based fibrous insulation materials

Description

This 12-month postdoctoral position forms part of the BIOMETA project, funded by the ANR for the period 2024–2028, and aims to optimise multi-physical performance and subsequently manufacture fire-retardant vegetal wools building insulation.

This work, initially carried out at the material scale, will be extended to the wall scale. The postdoctoral researcher will be able to rely on the works of three PhD thesis from the BIOMETA project relating to multi-criteria optimisation methods. The PhD theses focus, respectively, on the identification of a bio-based flame-retardant treatment and its impact on the acoustic and thermal performance of hemp wool [Schatzmayr Welp Sá *et al.* 2025] [Schatzmayr Welp Sá *et al.* 2026], and on the use of the double porosity and polydispersity of vegetal fibers to improve low-frequency acoustic performance [Mutel *et al.* 2025] [Mutel *et al.* 202-]. A third PhD thesis is currently underway, examining the impact of optimisations and the application of the treatment on the LCA of vegetal wools. The postdoctoral researcher will also be able to rely on the work of an initial 8-month postdoctoral position focusing on the anisotropy of vegetal wools and the analysis of how the angular orientation of fibers within materials influences acoustic performance.

The postdoctoral research will focus on three main themes:

- Finalising the optimisation of the acoustic performance of treated (fire-retardant) and untreated vegetal wools. This work may be combined with a joint optimisation with thermal performance. The proposed solutions must incorporate eco-design approaches, including life cycle assessment methodologies;
- Manufacturing of prototypes of optimised, fireproof vegetal wools in collaboration with Lermab (Épinal);
- Validation of the performance of the optimised vegetal wools through experimental characterisation at the material scale, then at the panel scale (acoustic, thermal, mechanical), followed by characterisation of acoustic behavior at the wall scale.

References :

- [Schatzmayr Welp Sá *et al.* 2025] T. Schatzmayr Welp Sá, S. Marceau, C. Piégay, P. Glé, F. Laoutid, C. Segovia, E. Gourlay, *Comparison of two flame-retardant treatment methods on bulk hemp fibers: Towards a large-scale viability as a raw material for building insulation*. Industrial Crops and Products, vol 228, 120903, ISSN 0926-6690, (2025) <https://doi.org/10.1016/j.indcrop.2025.120903>
- [Schatzmayr Welp Sá *et al.* 2026] T. Schatzmayr Welp Sá, S. Marceau, C. Piégay, P. Glé, F. Laoutid, C. Segovia, E. Gourlay, *Impact of a phosphorus-based fireproof treatment on the acoustic performances of bulk hemp fibers*. Applied Acoustics, vol 249, 111287, ISSN 0003-682X, (2026) <https://doi.org/10.1016/j.apacoust.2026.111287>
- [Mutel *et al.* 2025] L. Mutel, C. Piégay, P. Glé, E. Gourdon, C. Segovia, M. Ayadi, *Vegetal Wools for Building Application: Investigation of Optimization Approaches for the Enhancement of Low-Frequency Sound Absorption*. In: Amziane, S., Toledo Filho, R.D., da Gloria, M.Y.R., Page, J. (eds) Bio-Based Building Materials. ICBBM 2025. RILEM Bookseries, vol 60. Springer, Cham. (2025) https://doi.org/10.1007/978-3-031-92777-5_34
- [Mutel *et al.* 2026] L. Mutel, C. Piégay, P. Glé, E. Gourdon, C. Segovia, M. Ayadi, *Acoustic modelling of polydisperse vegetal wools: evaluation of analytic methods based on fibre radius distribution measurement*. Applied Acoustics, vol 253, 111384, ISSN 0003-682X, (2026) <https://doi.org/10.1016/j.apacoust.2026.111384>

Requirements / Skills

Knowledge:

- Proficiency in Python
- Acoustics of porous materials
- General knowledge of materials science (bio-based materials) : Thermal and mechanical properties of porous materials
- English: proficiency in everyday language and technical vocabulary relating to materials science

Expertise:

- Literature reviews
- Acoustic and thermal characterisation
- Data collection, processing and analysis
- Writing scientific articles

Interpersonal skills

- Ability to work independently
- Ability to organise and coordinate tasks
- Responsiveness
- Teamwork

Presentation of Cerema

Cerema, a public institution under the Ministry for Ecological Transition and Territorial Cohesion, is the first institution to be jointly managed by the State and local authorities. It operates at the local level through its 2,500 staff spread across 27 sites in Metropolitan France and the Overseas Territories.

With more than 70 years of expertise, Cerema is now a leading organisation supporting the State, local authorities and private companies in adapting to climate change. It also contributes to regional cohesion and the ecological transition of territories.

With strong potential for innovation and research, embodied in particular by its Carnot Clim'adapt Institute, Cerema operates in six areas of activity: Territorial Expertise & Engineering, Buildings, Mobility, Transport Infrastructure, Environment & Risks, and the Sea & Coastline.

General Informations / Postdoctoral context

Cerema's Eastern Regional Directorate consists of a general secretariat, the regional offices in Nancy and Strasbourg, and the 'Territories, Mobility and Infrastructure' department.

The Acoustics research team at the Strasbourg Agency is part of the Joint Research Unit in Environmental Acoustics (UMRAE), which is based in Nantes, Bron and Strasbourg. Its scientific programme aims to characterise and model environmental noise, assess the impacts of noise on wildlife and humans, and develop methods to reduce these impacts.

Hierarchical management

The recruited agent will be supervised by Clément PIÉGAY, a researcher in materials acoustics at UMRAE. The mission is part of the ANR BIOMETA research project related to the activities of the BioGéo Pole, whose members Philippe GLÉ (UMRAE) and Etienne GOURLAY will contribute to the scientific supervision of the postdoctoral researcher. In addition, the postdoctoral researcher will be required to use the facilities of one other partner involved in the BIOMETA project, namely Lermab, for the manufacture of materials. Travel expenses incurred in the course of the postdoctoral researcher's duties will be covered directly by the ANR BIOMETA research funding.

The postdoctoral researcher will report hierarchically and administratively to the Strasbourg Agency (UMRAE, Group Manager David Ecotière), but their work will be carried out under the functional supervision of Clément Piégay.

Hierarchical management

The recruited postdoctoral researcher will be supervised by Clément PIÉGAY, a researcher in materials acoustics at UMRAE. The mission is part of the ANR BIOMETA research project related to the activities of the BioGéo Pole, whose members Philippe GLÉ (UMRAE) and Etienne GOURLAY will contribute to the scientific supervision of the postdoctoral researcher. In addition, the postdoctoral researcher will be required to use the facilities of one other partner involved in the BIOMETA project, namely Lermab, for the manufacture of materials. Travel expenses incurred in the course of the postdoctoral researcher's duties will be covered directly by the ANR BIOMETA research funding.

The postdoctoral researcher will report hierarchically and administratively to the Strasbourg Agency (UMRAE, Group Manager David Ecotière), but their work will be carried out under the functional supervision of Clément Piégay.

Specificities / Conditions

The postdoctoral researcher will be based at the UMRAE offices at CEREMA in Strasbourg.

The postdoctoral researcher will be entitled to the flexible working hours scheme in force at the CEREMA office in Strasbourg.

The postdoctoral researcher will have access to a computer and the tools needed to process data and perform computer-related tasks.

Location

☒ **Cerema – Strasbourg** (11, rue Jean Mentelin, Strasbourg-Koenigshoffen, F-67035 Strasbourg)

Duration

Start date : 01/01/2027

End date : 31/12/2027

Duration : 12 months

Contact

M. Clément PIEGAY

Tél. 07 60 07 08 43

Email : clement.piegay@cerema.fr

www.umrae.fr