MINES PARIS | PSL | TTI.5° The Transition Institute

THESIS

ENERGY SAVING BY EMPLOYING THERMAL SUPERINSULATING BIO-AEROGELS

Project description:

Buildings use around 40% of the total energy consumption and generate 35% of total greenhouse gases. This is mainly linked to poor thermal insulation. Poor thermal insulation is also a problem for appliances and pipelines. To change this dramatic situation, high performance insulation materials are needed. The best commercial materials, such as mineral wool and expanded polystyrene, have conductivity between 0.030 and 0.035 W/(m.K). Apart from vacuum insulation panels, only aerogels are “intrinsically” thermal super-insulating materials at the atmospheric pressure (i.e. with thermal conductivity significantly below that of air, 0.025 W/(m.K)) due to their mesoporosity (pore size from 2 to 50 nm) and low density.

Low carbon footprint and “user-friendliness” are also very important factors to consider in addition to material performance. The goal of this PhD project is to develop bio-based materials, bio-aerogels, with very low thermal conductivity using a combined approach of formulation (chemical physics of polysaccharides) and experimental and modelling of material thermal properties. The work will be based on a recently discovered in CEMEF bio-based aerogels with very promising thermal properties.

The work is at the frontier of polymer chemical physics, materials’ processing and understanding of thermal conductivity of porous materials. It will involve the use of various approaches and techniques such as formulation, thermal conductivity measurements, rheology, optical and electron microscopies, characterisation of solutions, gels and porous materials. A certain part of work will be devoted to the basic modelling of thermal conductivity properties.

The work will be performed in two neighbouring research centers of Mines Paris: PERSEE and CEMEF. CEMEF is world leader in the development of biomass-based materials, in particular, in bio-aerogels, and PERSEE has in-depth expertise in aerogels for thermal insulation.

Keywords:

gels, bio-aerogels, polysaccharides, thermal conductivity of porous materials.

Skills:

knowledge in polymer chemical physics, capability to work in group, fluent in English, mobility, motivation and sense of initiative and capability to report regularly on his/her work.

Duration:

3 years

This a joint position in two research centers of Mines Paris – PSL:

- Centre for Processes, Renewable Energies and Energy Systems (PERSEE)
- Centre for Materials Forming (CEMEF)

Both centers are located: Rue Claude Daunesse, CS 10207, 06904 Sophia Antipolis

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THIS PHD WILL TAKE PLACE WITHIN THE FRAMEWORK OF THE TRANSITION INSTITUTE 1.5 (TTI.5).

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