Junior Professorship open in 2025 at the University of Bordeaux – France

Title : Thermal battery for environmentally friendly low temperature heat storage energy (BETTER)

Energy storage is a major challenge, closely related to energy sobriety and sustainable development. In addition to the storage of primary or slightly transformed energy, the storage of the degraded form of energy, i.e., heat, is of prime interest. The aim here is to abandon electrical storage and rather, create a "thermal battery" for direct use of heat without costly energy transformation. Target applications are in the domain of transport and housing.

Low-temperature heat storage in a thermal battery requires the use of materials that can store/release as much heat as possible per unit mass of the material, at temperatures below 50°C. Typically, a distinction is made between latent heat and/or sensible heat storage systems. Latent heat storage, which relies on the phase change of the material, requires the material to have a low melting point. Sensible heat storage requires a material with a very high heat capacity. The use of a pure fluid confined near its liquid-gas critical point potentially has sensible heat storage properties of particular interest. Indeed, under such thermodynamic conditions, the fluid exhibits a very high heat capacity. Carbon dioxide could be an excellent choice, given its abundance and safety, as well as its low values of the temperature and pressure at the critical point. Taken separately or in combination, these two approaches represent a real breakthrough in the way heat storage is approached. The project is firmly focused on this type of solution.

The skills required to carry out this project - and first and foremost to achieve proof of concept in terms of energy performance - are very strongly centered on the know-how developed at the “Institut de Mécanique et d’Ingénierie” (I2M) in Bordeaux (France), particularly in the field of the physics of coupled heat/mass/momentum transfers, through complementary theoretical, experimental, characterization and design, modeling and simulation approaches. For devices development, other I2M skills will also need to be mobilized, in particular regarding design, manufacturing, mechanical strength and non-destructive evaluation. In addition, since the choice of storage materials and vectors must comply with today's necessary environmental constraints, evaluating the environmental impact of the solution through life-cycle analysis approaches is of great interest. Last but not least, close collaboration with the expertise in chemistry, materials and environmental impact available on the Bordeaux university campus is also envisaged (Institut de Chimie de la Matière Condensée de Bordeaux (ICMCB), Institut des Sciences Moléculaires (ISM)). This project offers a wide range of opportunities for collaboration with industries in the domains under concern, as well as regional, national (and international) research laboratories.

The candidate, between 35 and 42 years old, may be an experimentalist, a specialist in numerical modeling or a theoretician in fluid mechanics and transfer processes, capable of coordinating the different aspects and skills related to the project, with a taste for pedagogical illustrations.

A longer version of the offer description is available at https://www.u-bordeaux.fr/application/files/5817/5024/2856/CPJ_60-62_-_BETTER.pdf

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