



Project Title:	Hunting for the perfect phase change material (PCM) for the built environment
Lead Supervisor and co-supervisors:	Dr Veronica Ferrandiz-Mas (lead) Dr. Stephen Allen
Industrial Partner:	N/A

#### Project Summary

We are looking to recruit a PhD student to optimise and develop new phase change materials (PCMs) for the built environment. These materials can reduce carbon emissions and improve thermal comfort for occupants of buildings.

The built environment in UK is responsible for 40% of the UK's total carbon emissions. Much existing building stock is energy inefficient, which results in two-thirds of the UK's residential energy consumption being used for heating. In addition, climate change trends predict an increase in temperatures within the UK, which will lead to increased energy consumption to maintain indoor thermal comfort. This results in high cost energy bills and high carbon emissions. Although the UK is trying to retrofit the existing building stock, the rate of decarbonisation appears too slow to meet carbon neutral objectives by 2050.

Decarbonisation rates can be increased and energy bills reduced if buildings are retrofitted with energy-efficient materials, such as phase change materials (PCMs). PCMs use latent heat storage during the phase transition process to actively release or store thermal energy during phase changes. By doing this, they can cause tangible changes to the thermal environment of a building and thus reduce energy demands. There are two ways of doing this: PCMs can reduce the peak thermal load by acting as a thermal buffer, reducing room temperature fluctuations; they can as well offset the peak thermal loads from the hottest and coldest parts of the day. Despite the promising potential of these materials, the widespread implementation of PCMs has not as yet been achieved. This is mainly due to lack of understanding of the technology and poor benefit-to-cost ratio. There are many contributors to this problem, but a key one is the limited range of PCMs currently available that can be used in buildings. There is a need to develop new substances as well as enhance existing ones, to improve energy performance and cost. There is also a need to characterise the environmental impacts of their production, use and disposal, and ensure they provide net carbon benefits. Efficient, cheap and low carbon PCMs for the built environment would contribute to decarbonisation of existing building stock and reduce energy demand of future ones. Thus, this project will optimise PCMs for the built environment having into account the aforementioned criteria, building a data base of possible candidates and modelling their key properties. This project will also involve experimental testing and life cycle assessment. Development of these areas will drive acceptance and successful integration in the market, and thus reduce the energy used in buildings and carbon emissions.



The ideal PhD candidate will have a strong Chemical background or any close related discipline and will be familiar with one or more of the following topics: materials characterisation, building physics, thermodynamics, life cycle assessment, modelling.

#### Sustainability issues addressed

This research project, by looking to optimise and develop phase change materials (PCMs) for the built environment and consequently improve their energy efficiency and cost, will contribute to the much needed decarbonisation of this sector, key to have achieve Net Zero targets in the UK and internationally.

#### Eligibility criteria and selection process

##### **Candidate Requirements:**

Applicants should hold, or expect to receive, an undergraduate Masters first class degree or MSc distinction (or equivalent degree from a non-UK top-tier University). Other desirable requirements are: degree in Chemistry or related discipline with strong interest in applied engineering, lab experience and some knowledge of mathematical modelling. English language entry requirements must be met at the time of application to be considered for funding, see [Postgraduate English language requirements for international students \(bath.ac.uk\)](https://www.bath.ac.uk/postgraduate/english-language-requirements/)

##### **Application:**

Informal queries should be directed to Dr Veronica Ferrandiz-Mas - [vfm24@bath.ac.uk](mailto:vfm24@bath.ac.uk)

Formal applications should be made via the University of Bath's online application form for a PhD in Architecture & Civil Engineering. Please ensure that you state the full project title and lead supervisor name on the application form. Please state if you wish to apply for a Global Doctoral Scholarship as part of the URSA PhD studentship competition.

<http://www.bath.ac.uk/guides/how-to-apply-for-doctoral-study/>

Expected start date: 4 October 2021

##### **Funding Eligibility:**

An URSA PhD studentship includes 'Home' tuition fees, a stipend (£15,609 per annum, 2021/22 rate) and research/training expenses (£1,000 per annum) for up to 3.5 years. For 2021/22 the Faculty of Engineering & Design has two Global Doctoral Scholarship awards. These awards will be allocated in conjunction with the URSA PhD studentship competition and will cover the difference between home fees and overseas fees. The Global Doctoral Scholarship awards are very competitive and there is no guarantee that an accepted student will be awarded one.

Information may be found on our [fee status guidance webpage](#), on the [GOV.UK website](https://www.gov.uk) and on the [UKCISA website](#).