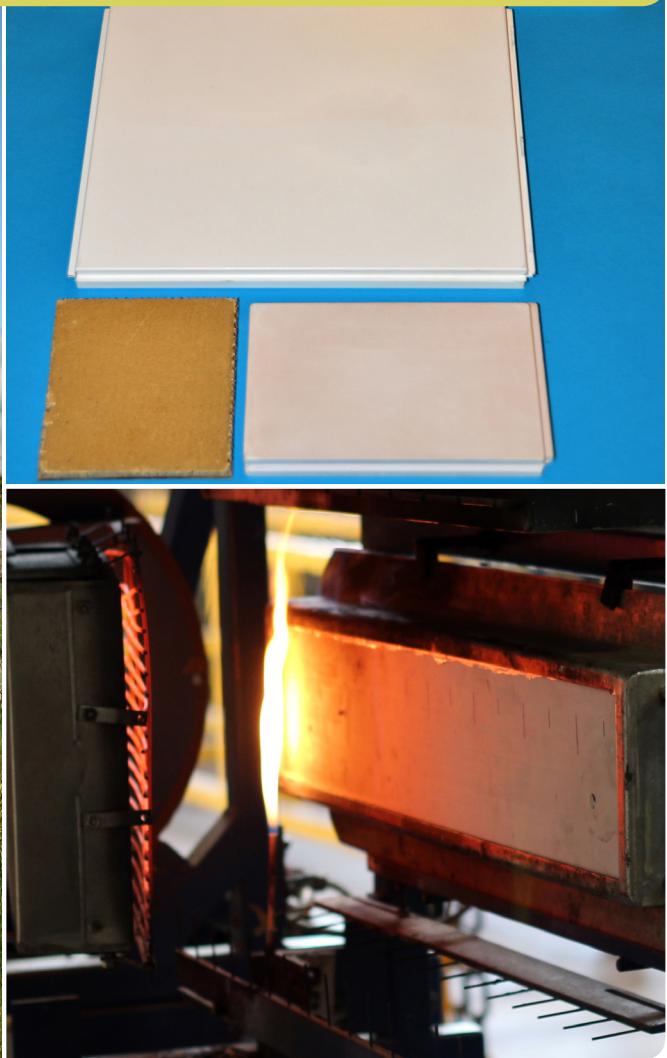


Assessing the performance of Phase Change Materials in buildings

Corinne Williams



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Executive summary

Phase change materials (PCMs or latent heat storage materials) for building applications are an emerging technology in the UK. PCMs are now becoming available incorporated into different building products; they come in different physical forms and with different transition temperatures. They can provide additional thermal mass to otherwise thermally lightweight buildings currently being constructed and to existing building stock. There is a need to establish sound methodologies for determining the true benefits of these products when installed in a building throughout their life, and for assessing the impact of incorporation of PCMs on broader building performance characteristics.

This publication provides an overview of PCM building products and available methodologies for assessing them. It will be of interest to specifiers, designers, installers, approving authorities, manufacturers, fire safety risk assessors and other interested parties to ensure that this technology is properly considered.

The first part of this publication provides an introduction to the subject of PCM building products. It covers the following subjects: what they are and how they work, their benefits, current technical developments and available products. The second part covers the assessment (test and evaluation methodologies) of PCMs for building applications for long-term thermal performance, environmental impact, structural performance, health and safety considerations, and performance in fire and quality standards.

1 Introduction

Traditional construction relies on heavyweight structures with high thermal mass to achieve effective energy storage in the construction's fabric. Modern, lightweight structures, with low thermal mass, can be susceptible to overheating^[1, 2] due to solar heating and internal heat gains which cannot be absorbed by the structure or being too cold when external temperatures are too low. Air conditioning and heating systems are often specified to make the internal temperatures acceptable.

Phase Change Materials (PCMs), or latent heat storage materials for building applications, are an emerging technology in the UK. They offer a solution for improving the thermal performance and comfort of low thermal mass buildings currently being constructed using modern materials and techniques and also when renovating existing building stock.

PCMs can be used to provide thermal mass to buildings with low thermal mass. They can smooth the daily fluctuations in internal temperatures by lowering the peak temperatures resulting from extreme external temperature changes and can prevent overheating (Figure 1). PCMs can reduce the capacity of mechanical heating or cooling systems.

PCMs come in many physical forms and are available for different transition or operating temperatures. PCMs have now become available and incorporated into different building products.

This publication concentrates on PCMs as part of a passive/fabric/thermal mass approach but it should be noted that PCMs can also be used as part of low energy ventilation and cooling systems and other emerging applications.

The publication provides introductory information about PCM building products and available methodologies for assessing them for specifiers, designers, approving authorities, manufacturers, fire safety risk assessors and other interested parties so they can ensure that this technology is properly considered on individual building projects.

1.1 PCM building products and other temperature control measures

PCM building products, like sensible thermal mass, should be considered as part of the overall package of temperature control measures in a building. These include insulation, shading, building orientation and ventilation. PCMs may not always be the best or only solution and alternative measures should be considered to ensure that the most appropriate form of temperature control measure is used.

It may be advisable for specialist advice to be sought in the early stages when considering the use of PCM and PCM composite building products to ensure their correct application.

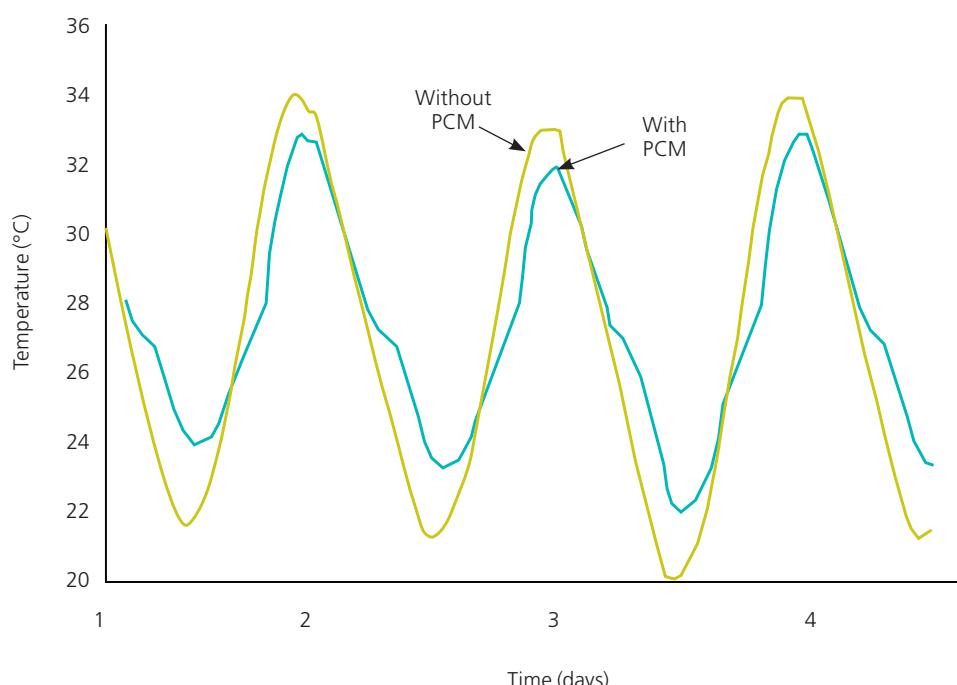


Figure 1: Indoor air temperature versus time, with and without PCM, showing how PCM building products can lower peak internal temperatures

Assessing the performance of Phase Change Materials in buildings

Phase Change Materials (PCMs or latent heat storage materials) incorporated into various building products are now becoming available. They offer a solution for improving the thermal performance and comfort of low thermal mass buildings and are capable of smoothing the daily fluctuations in peak internal temperatures resulting from extreme external temperatures changes.

This publication will help you keep abreast of this emerging technology; it provides an overview of PCM building products and available methodologies for assessing them.



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