

Review

A Review of Recent Improvements, Developments, and Effects of Using Phase-Change Materials in Buildings to Store Thermal Energy

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Abstract: When it comes to guaranteeing appropriate performance for buildings in terms of energy efficiency, the building envelope is a crucial component that must be presented. When a substance goes through a phase transition and either gives out or absorbs an amount of energy to provide useful heat or cooling, it is called a phase-change material, or PCM for short. Transitions often take place between the matter's solid and liquid states. Buildings use PCMs for a variety of purposes, including thermal comfort, energy conservation, managing the temperature of building materials, reducing cooling/heating loads, efficiency, and thermal load shifting. Improved solutions are applied using new method and approach investigations. Undoubtedly, researching and applying PCM use in building applications can help create buildings that are more energy-efficient and environmentally friendly, while also increasing thermal comfort and consuming less energy. It provides a possible answer to the problems posed by climate change, rising energy demand in the built environment, and energy use optimisation. However, it is true that no particular research has yet been conducted to thoroughly analyse the linked PCM applications in the building industry. Thus, the principal tactics are addressed in this paper to determine current and efficient methods for employing PCMs in buildings to store thermal energy. By gathering around 50 instances from the open literature, this study conducts a thorough assessment of the up-to-date studies between 2016 and 2023 that used PCMs as thermal energy storage in building applications. As a result, this review aims to critically evaluate the PCM integration in buildings for thermal energy storage, identify a number of issues that require more research, and draw some important conclusions from the body of literature. Specifically, the building envelope roof and external wall uses of PCMs are highlighted in this research. Applications, general and desired characteristics, and PCM types and their thermal behaviour are described. In comparison to a traditional heat storage tank that simply contains water, this review indicates that a water storage tank containing 15% PCM improves heat storage by 70%. Also, less than 7 °C of internal air temperature was reduced by the PCMs in the walls, which avoided summer warming. Finally, using PCM for space cooling resulted in substantial energy savings across the various seasons.

Keywords: PCMs; thermal comfort; energy savings; cooling/heating load reduction; thermal load shaving and shifting



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Thermal Insulation Recent Developments Energy Technology Review

Mike Jess



Thermal Insulation Recent Developments Energy Technology Review:

Sustainable Energy Technologies and Low Carbon Buildings Saffa Riffat, Mardiana Idayu Ahmad, Aliff Shakir, 2024-12-28 This book aims to offer an in depth guide and fundamental comprehension of sustainable energy technologies and their essential function in decreasing energy consumption in buildings under diverse climatic conditions It has been designed to stimulate additional research and innovation especially in the field of green technology for building applications This book embodies the culmination of extensive research and case studies encompassing the initial developments to the latest advancements in sustainable energy systems particularly emphasising energy efficient building technologies It also highlights up to date reviews and research into meeting low and zero carbon demand in buildings and includes extensive coverage of established and emerging sustainable energy technologies for building applications addressing their physical principles mechanisms applications and cutting edge technological advances The coverage of book is divided into five main parts Thermal energy efficient systems Sustainable power generation Energy efficient lighting technologies Zero energy and low carbon buildings and Eco cities as sustainable urban living Taken together they provide a concise explanation of low and zero carbon buildings role in tackling the world s energy challenges with an emphasis on design conversion techniques and materials and on the economic and environmental assessment of technology Innovative concepts design and planning in connection with global urbanization and improving sustainable development are also discussed In addition the book features case studies on worldwide sustainable energy technologies low and zero carbon buildings and eco cities as sustainable urban environments This book offers a valuable source of information for developers architects building managers and owners and engineers working in sustainable energy fields as it provides in depth information on a diverse range of technologies designed to achieve environmentally friendly solutions The book also benefits students and academics as it offers optimal supporting material for an introductory course in this field

Low Carbon Energy Supply Technologies and Systems Atul Sharma, Amritanshu Shukla, Renu Singh, 2020-05-26 Future energy technologies must embrace and achieve sustainability by displacing fossil carbon intensive energy consumption or capture reuse sequester fossil carbon This book provides a deeper knowledge on individual low and zero carbon technologies in a comprehensive way covering details of recent developments on these technologies in different countries It also covers materials and processes involved in energy generation transmission distribution storage policies and so forth including solar electrical thermal systems energy from biomass and biofuels energy transmission distribution and storage and buildings using energy efficient lighting

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web in this activity students will work in groups to design and build a small boat from aluminum foil they will then see how many pennies it can hold before it sinks the goal is for each student to work with their group to build and modify

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web you can only use one piece of aluminum foil the square of foil must measure 5 inches x 5 inches the boat must hold at least 15 pennies without sinking or capsizing brainstorm designs get ready to experiment use a ruler and scissors to cut a 5

inch square piece of aluminum foil for your boat

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web it has to do with the density or the mass per volume of the ship and its cargo compared to the density of water in this science activity you will make little boats out of aluminum foil to explore how their size affects how much weight they carry and how this relates to the density of water

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web check out the buoyancy boats in the fun stem activities on a budget post for an example of aluminum foil boats make your boat design in 3 or 4 different sizes we simply cut a flat boat shape out the foam sheets place the boats in some water double check that they float add weight to each of the boats we used washers for our weights

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web 1 construct your boat from one sheet of aluminum foil 2 calculate the volume of each boat by measuring the length width and height in centimeters

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web sep 19 2017 2 sheets of aluminum foil 5 5 inches in length each 1 container that can hold 3 5 inches of water several paper towels or rags that can be placed under the container 15 pennies one copy of the aluminum boats student activity

guide

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