

# Asphalt phase change energy storage microcapsules

Do microcapsules improve thermal and mechanical performance of PCMS?

Microcapsules enhance thermal and mechanical performance of PCMs used in thermal energy storage by increasing the heat transfer area and preventing the leakage of melting materials. Nowadays, a large number of studies about PCM microcapsules have been published to elaborate their benefits in energy systems.

What are phase change materials (PCMs)?

Phase change materials (PCMs) are gaining increasing attention and becoming popular in the thermal energy storage field. Microcapsules enhance thermal and mechanical performance of PCMs used in thermal energy storage by increasing the heat transfer area and preventing the leakage of melting materials.

Are PCM microcapsules good for asphalt?

Above all, asphalt mixtures containing reinforced PCM microcapsules have been proved acceptable via dynamic stability tests. The bending beam rheometer test results imply that asphalt mixture containing PCM microcapsules revealed good crack resistance at low temperatures.

Can microencapsulation solve the problem of melt exudation of phase change materials?

The microencapsulation of phase change materials can solve the problem of melt exudation of these materials during the phase change process, improve the environmental adaptability of these materials, and expand their applications. This article mainly reviewed the preparation and application of HTPCM above 300 °C.

Are PCM microcapsules suitable for thermal energy storage?

In this paper, a comprehensive review has been carried out on PCM microcapsules for thermal energy storage. Five aspects have been discussed in this review: classification of PCMs, encapsulation shell materials, microencapsulation techniques, PCM microcapsules' characterizations, and thermal applications.

What are phase change materials?

Phase change materials provide a type of thermal energy storage that can store a large amount of latent heat through physical phase change. This heat is then released in a controlled manner within a small temperature change based on thermal energy requirements.

RARE METALS Vol.25, Spec. Issue, Oct2006, p.393 Research on microcapsules of phase change materials DAI Xia, and SHEN Xiaodong Material College of Nanjing University of Technology, Nanjing 210009, China (Received 2006-06-26) Abstract: Microcapsule technology is a kind of technology wrapping the solid or liquid into minute-sized particles within the field of ...

Phase-change microcapsules have been synthesized with melamine formaldehyde resin (MF) ... Previous molecular dynamics simulations implied that adding CG could enhance the heat-conducting performance of asphalt and phase-change energy storage/release efficiency of phase-change microcapsules [26], [28]. This

study experimentally validated the ...

The development of phase change energy storage technology promotes the rational utilization of renewable energy, and the core of this technology is phase change material (PCM). Hydrated salt as PCM is successfully applied in various fields, especially its application in green building attracts the most attention.

Due to their large storage capacity and thermal stability of the thermal storage process, phase change microcapsules have attracted great attention, extending their use to ...

A less studied method is the use of PCM microcapsules, which also presents challenges since most microcapsules are not strong nor stable enough to survive the high temperatures and compressive forces experienced during asphalt mixture production and placement. ... A review on phase change energy storage: materials and applications. Energy ...

Phase change materials (PCMs) are considered one of the most promising energy storage methods owing to their beneficial effects on a larger latent heat, smaller volume change, and easier controlling than other materials. PCMs are widely used in solar energy heating, industrial waste heat utilization, energy conservation in the construction industry, and other ...

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Phase change materials, also known as latent heat storage materials, store/release large amounts of energy by forming and breaking the chemical bonds between molecules [3, 4]. Phase change materials have limited thermal conductivity and suffer from leakage of liquid materials after melting [5] addition, traditional composite phase change materials gradually ...

The greater the incorporation of phase change microcapsules, the more pronounced the temperature-regulating effect. However, the associated costs also increased correspondingly. When the content of phase change microcapsules reached 7 % of the total asphalt mass, the cost increased by approximately 2.1 %/m<sup>3</sup>. This dosage not only achieved ...

Since the first oil crisis in 1970, scientists around the world have begun seeking new sources of energy and exploring new ways to manage energy. Energy storage in industrial energy conservation and new energy applications have gained the most attention; among these, low-cost phase change materials (PCMs) became popular because of their high ...

Wang et al. [27]. encapsulated refined waste engine oil in microcapsules and incorporated them into asphalt, observing enhancements in viscosity and rheological properties of the asphalt. Additionally, the study revealed

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that the use of waste engine oil microcapsules prolonged the fatigue life of asphalt, accelerated the recovery of composite material modulus, ...

Molecular simulation and indoor test research show that the road performance of a modified asphalt mixture, prepared with graphene (CG) modified asphalt, will be enhanced [41,42,43], and the phase change energy ...

Phase change materials (PCMs) can regulate the temperature in asphalt pavement and minimize temperature-related problems, such as rutting and thermal cracking, because of their ability to store ...

In recent years, phase change materials (PCM) as an important approach for thermal energy storage have attracted growing attention due to the rapidly increasing depletion of fossil fuels referred to coal, oil and natural gas, which has led to severe air pollution and global warming [[1], [2], [3]]. PCM, can store or release a large amount of latent heat during phase ...

Phase change materials (PCMs) are gaining increasing attention and becoming popular in the thermal energy storage field. Microcapsules enhance thermal and mechanical performance of PCMs used in thermal ...

The previous research results revealed that the modified asphalt specimens after adding phase-change microcapsules with melamine formaldehyde resin (MF) and n ...

Thermal energy storage technology based on phase change materials (PCMs) is promising for temperature regulation and thermal energy storage. However, the applications of organic PCMs are hindered ...

The microencapsulation of phase change materials can solve the problem of melt exudation of these materials during the phase change process, improve the...

The total energy storage process which includes the heating process to the phase-changing point and phase-changing process needs 280 s for mBPs-MPCM and 850 s for mBPs decorated MPCM, implying that mBPs ...

"Developing a solid-solid phase change heat storage asphalt pavement material and its application as functional filler for cooling asphalt pavement." ... properties of textile materials modified with PCM microcapsules." Appl ... of asphalt modified by polyurethane solid-solid phase change material." Sol. Energy 194 (Dec ...

In order to address the problem, phase-change material (PCM) microcapsules working at 0-10°C are used to replace some of the aggregates in asphalt. In this study, PCM microcapsules with ...

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The main reasons for restricting the development of this technology include the lack of suitability between the PCMs and asphalt pavement, the quantitative characterization of phase change temperature regulation property, and the evaluation of the effect of phase change energy storage on improving pavement performance.

elusive in the field of low temperature energy storage. Based on the comparative analysis on the existing researches, the effects and potential of different ... phase change microcapsules using Rubitherm RT-42 paraffin as core and polyurea formaldehyde as shell. The latent heat value of microcapsule reached the maximum

In the past few years, the use of phase change materials (PCM) as novel asphalt binder modifier increasingly attracted the interest of pavement researchers [4, 5]. These materials may be incorporated in asphalt binders in order to minimize the thermal distresses due to extremes temperature variations in asphalt mixtures [6]. With the ability to change its phase ...

Phase change materials (PCMs) are latent heat storage materials that absorb or release heat under almost isothermal conditions. In terms of adjusting or regulating ...

Preparation of phase change materials with higher heat resistance is of great significance for their popularization and application. In this study, based on phase-change microcapsules (micro-PCMs) with epoxy resin as the capsule shell, microcapsules were compounded with different types of epoxy resins to prepare micro-PCMs and epoxy resin ...

During the construction and maintenance of asphalt pavement, a lot of non-renewable resources are consumed, which discharge a variety of waste gasses and smoke, causing a serious impact on the environment. Reducing ...

Properties and applications of shape-stabilized phase change energy storage materials based on porous material support--A review. *Materials Today Sustainability*, Volume 21, 2023, Article 100336 ... Synthesis and thermal properties of n-tetradecane phase change microcapsules for cold storage. *Journal of Energy Storage*, Volume 52, Part B, 2022 ...

With relatively low phase-change enthalpies, the signal functional phase-change microcapsules are mainly developed for traditional applications in thermal energy storage and management such as energy-saving buildings, latent functional thermal fluids, heating/cooling exchange systems, fibers and textiles, food industry and solar thermal energy ...

Research progress of high-temperature phase change energy storage microcapsules[J]. *Chinese Journal of Engineering*, 2021, 43(1): 108-118. DOI: 10.13374/j.issn2095-9389.2020.07.21.004 Citation: JIANG Yu,

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WANG Qian, WANG Dong, ZHAO Tong. Research progress of high-temperature phase change energy storage microcapsules[J].

In this article, a two-component organic low-temperature PCM was encapsulated by melamine-urea-formaldehyde resin and finally reinforced with polypropylene. The ...

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