# Thermophysical Properties of n-Alkane Systems for Low Temperature Thermal Energy Storage

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Over the past few decades, the escalating need for energy has posed a significant and pressing challenge. For centuries, fossil fuels stood as the dominant energy source; however, due to their dwindling availability and environmental complications, renewable energies have emerged as the promising solution for the future [1]. The intermittent nature of renewable energy sources often results in a disconnect between energy production and consumption, underscoring the vital role of energy storage technologies in enhancing clean energy utilization [2]. Among various energy storage solutions, thermal energy storage (TES) shines as one of the most promising options, offering substantial energy storage capacity at a relatively low cost [3]. In this context, phase change materials (PCMs) are particularly crucial, namely for active cooling systems. Linear alkanes (*n*-alkanes) have been widely investigated for TES applications due to their singular characteristics including their phase transition performance [4].

The objective of this work is to characterize selected *n*-alkane systems, involving the construction of the solid-liquid binary phase diagrams, using differential scanning calorimetry (DSC) and Raman spectroscopy. Additionally, the present research efforts seek to obtain the thermal conductivity of these systems. The ongoing investigations play a critical role towards understanding the properties of these systems, enabling prediction of their thermal characteristics and performance as PCMs for TES applications. Particularly, for new PCMs phase equilibrium studies are essential in selecting systems with the desired properties tailored to specific applications.

This work is focused on binary systems composed of odd and even alkanes, in particular the binary mixtures $C_8$–$C_{10}$, $C_9$–$C_{10}$, $C_9$–$C_{11}$, and $C_{10}$–$C_{12}$. These systems revealed different solid-liquid phase equilibrium behavior at low temperatures, with three of the four systems demonstrating promising capabilities for low-temperature TES applications. Detailed results on these binary systems will be presented and discussed.

**Acknowledgments**

Centro de Química Estrutural and Centro de Química de Coimbra are Research Units funded by Fundação para a Ciência e Tecnologia through projects UIDB/00100/2020 and UIDP/00100/2020, and UIDB/00313/2020 and UIDP/00313/2020, respectively. Institute of Molecular Sciences is an Associate Laboratory funded by FCT through project LA/P/0056/2020. M.C.M. Sequeira acknowledges the PhD grant funded by FCT ref. UI/BD/152239/2021.

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