



**Pole for Doctoral Studies  
Center for Doctoral Studies  
Sciences, Technologies, and Medical Sciences**

## **ANNOUNCEMENT OF DOCTORAL THESIS DEFENSE**



**M. BRIACHE Ayoub**

**Will present here research work with the aim of earning a  
Doctorate**

**Doctoral program: Engineering Sciences and Techniques  
Discipline: Energy and Mechanics  
Specialty: Energetics**

**On 24/07/2025 at 10H00 at the Conference Hall, F Building,  
Faculty of Sciences and Techniques of Tangier, UAE  
Under the Theme**

**Intensification of Heat Transfer in Phase Change Material during  
Solid-Liquid transition**

**Front of the jury composed of :**

<b>First Name &amp; Last Name</b>	<b>Establishment</b>	<b>Designation</b>
<b>Pr. HARMAND Souad</b>	<b>UPHF, France</b>	<b>President</b>
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<b>Pr. AHACHAD Mohammed</b>	<b>FST of Tangier, UAE</b>	<b>Examiner</b>
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**Research Laboratory: Materials, Systems and Energy Engineering (MaSEEL)**

## Abstract



This thesis investigates the intensification of heat transfer in latent heat thermal energy storage (LHTES) systems using phase change materials (PCMs), with a focus on both experimental and numerical approaches. The study begins with a comprehensive literature review outlining the principles, classification, and applications of PCMs in areas such as thermal energy storage and electronic cooling.

Experimental investigations examine the impact of tube positioning, system orientation, and multi-tube configurations using lauric acid as the PCM. Results show significant improvements in melting time and thermal performance, particularly when using bottom-positioned or horizontally-aligned double tubes.

A validated numerical model using the finite volume method further explores enhancement techniques under heat flux boundary conditions. The effects of fins, copper nanoparticles, and metal foams are assessed. Findings indicate that while metal foam and fin integration greatly enhance heat transfer, they can reduce the total latent heat storage capacity, highlighting the need for optimization.

The study also explores PCM-based electronic cooling applications, demonstrating that fins and high-porosity metal foams provide efficient temperature control under varying heat fluxes. Nanoparticles improve thermal conductivity but show limited impact on melting rates at lower concentrations.

Overall, the thesis contributes valuable insights into the design and optimization of PCM-based systems, emphasizing the importance of geometric configurations and material enhancements. It concludes with recommendations for future research, including large-scale implementation and integration with smart energy systems to support sustainable thermal management solutions.

**Keywords:** Thermal energy storage, Tube heat exchangers, Heat transfer Enhancement, Phase change material, Fins, Metal foam. Thermal Management; Heat Sink; Phase Change Material, Thermal Energy Storage.