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COOL

Experimental evaluation of different macro-encapsulation designs for PCM storages for cooling applications

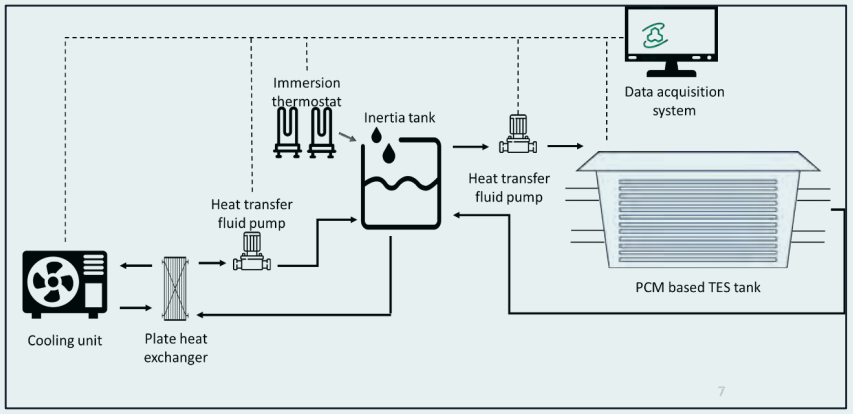
Student: Omais Abdur Rehman
Advisors: Prof. Luisa F. Cabeza
Dr. Andrea Frazzica
Dr. Valeria Palomba

Introduction

This research activity presents a comprehensive performance evaluation of a latent heat thermal energy storage unit featuring three distinct macro-encapsulation designs for phase change materials. The study aims to assess the thermal performance, efficiency, and practical applicability of these macro-encapsulation designs in a storage system.

Schematic description

- Experiments are carried out at a research facility in GREiA research group.
- The system consists of a TES tank, cooling unit, immersion electrical heaters, inertial tank and fluid pumps.
- The temperature inside the TES tank is maintained through the water inertia tank.
- For charging the TES tank, temperature inside the inertia tank is increased through immersion heaters.
- For discharging process, tank is cooled down using a chiller.
- The speeds of two pumps is controlled to keep temperature and mass flow rate constant at inlet of TES tank.
- The commercial tank used for this scientific study has a volume of 490 litres.

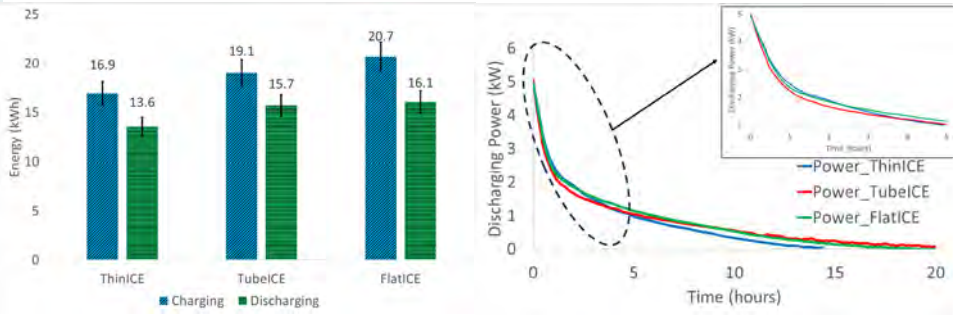


Materials and methods

- PlusICE S17 (salt hydrate), a commercial product of PCM products, is used for this scientific study.
- Three different macro-encapsulation designs namely ThinICE, TubeICE and FlatICE (as shown in figure) are used for experiments.
- The temperature for charging and discharging of PCM tank was taken as 27°C and 7 °C which is ±10 °C of melting point of PCM i.e., 17 °C.

Results

- Performance of TES unit is analysed in terms of storage capacity, heat transfer rate profiles and temperature distribution inside the tank.
- TubeICE has the highest storage efficiency followed by ThinICE and FlatICE.
- ThinICE provides higher power for shorter period of time while TubeICE and FlatICE provided stable power for longer time.



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