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Encapsulation of Phase Change Materials and use in Thermal Energy Storage

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Encapsulation of Phase Change Materials and Its Application in Thermal Energy Storage Systems

Introduction:

The intermittent nature of Sunlight hinders the use of this energy resource . Thermal energy storage is a viable solution to this problem. The commonly used approaches for thermal energy storage include

- ❖ Sensible heat storage
- ❖ Latent heat storage
- ❖ Chemical energy storage

Advantages of latent heat storage systems:

- ❖ Low Cost
- ❖ High Energy Storage Density
- ❖ Non-toxic and stable
- ❖ Heat stored nearly isothermal way

Heat transfer enhancement techniques:

- ❖ Incorporation of a metal matrix
- ❖ Dispersed with highly conductive particles
- ❖ Micro and macro encapsulation

Objective:

- ❖ Macro-encapsulation of the PCM
- ❖ Encapsulating material needs to be stable & non-reactive with the PCM over successive thermal cycles.
- ❖ Set-up a latent heat storage packed bed to test the charging-discharging behavior of the system.

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Encapsulation procedure

Powder PCM
↓ Hydraulic Press
Pressed PCM Pellets
↓ Polymer Coating
Polymer Coated Capsule

I. Electroless Deposition
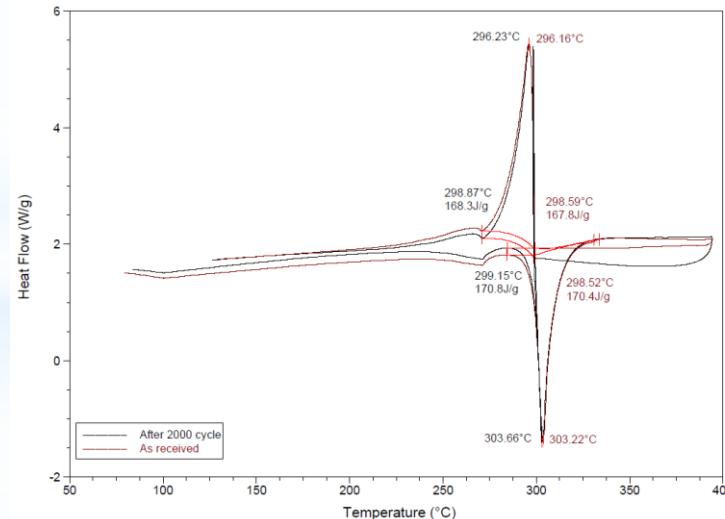II. Electrolytic Plating → Metal coated Capsule

Thermal cycling

Passed >2000 cycles at 326 °C

770 Capsules are made for packed bed storage

DSC analysis of as received and 2000 cycle passed capsule

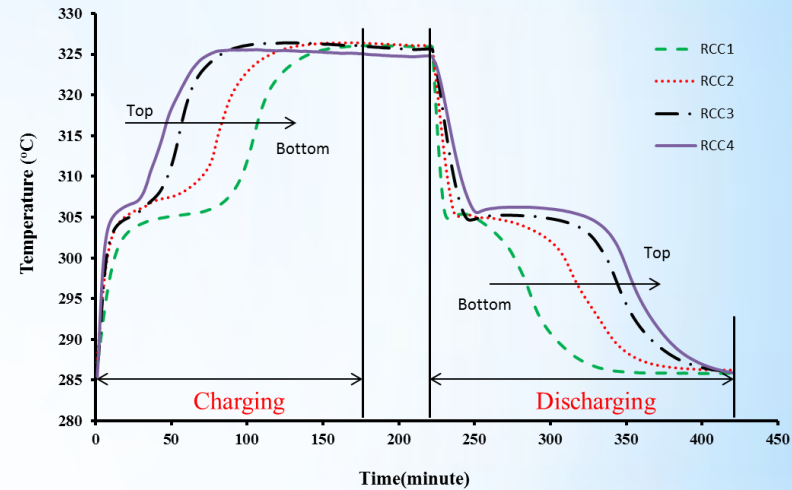# Encapsulation of the Phase Change Materials and use in Thermal Energy Storage
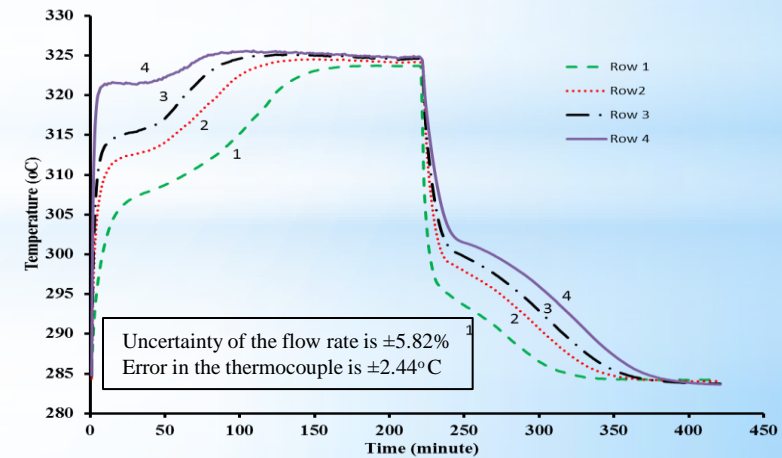
Complete Packed Bed Setup

- Heater
- Blower
- Supporting Structure
- Packed Bed
- Lab View
- Control Panel
- Heater

Temperature profile for thermocouple Inside the capsule

- RCC1
- RCC2
- RCC3
- RCC4

Top / Bottom — Charging / Discharging

Average Temperature Distribution in the Packed bed

- Row 1
- Row2
- Row 3
- Row 4

Uncertainty of the flow rate is ±5.82%
Error in the thermocouple is ±2.44°C

➢ Storage capacity= 0.904 KW-h

➢ Tank diameter= 10 inch

➢ Tank height= 10 inch

➢ Heat transfer fluid= Air

➢ Porosity=0.35

Flow rate:
  151 m^3/hr

Thank You