LATENT SOLAR THERMAL ENERGY STORAGE: THE EFFECT OF PHASE CHANGE MATERIAL DOMAIN

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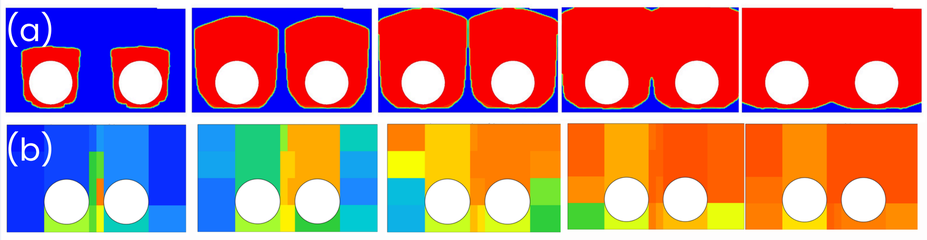
INTRODUCTION

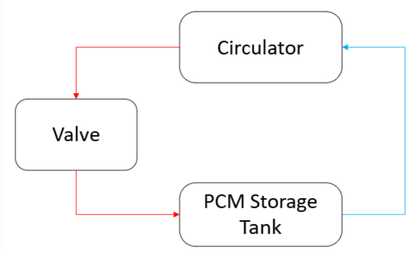
- Investigated the effect of PCM domain geometry on latent thermal energy storage performance.
- Analyzed the influence of geometry on heat transfer mechanisms, melting behavior, and thermal storage efficiency.
- Identified the most effective geometric configuration for enhancing charging and discharging performance.

METHODOLOGY

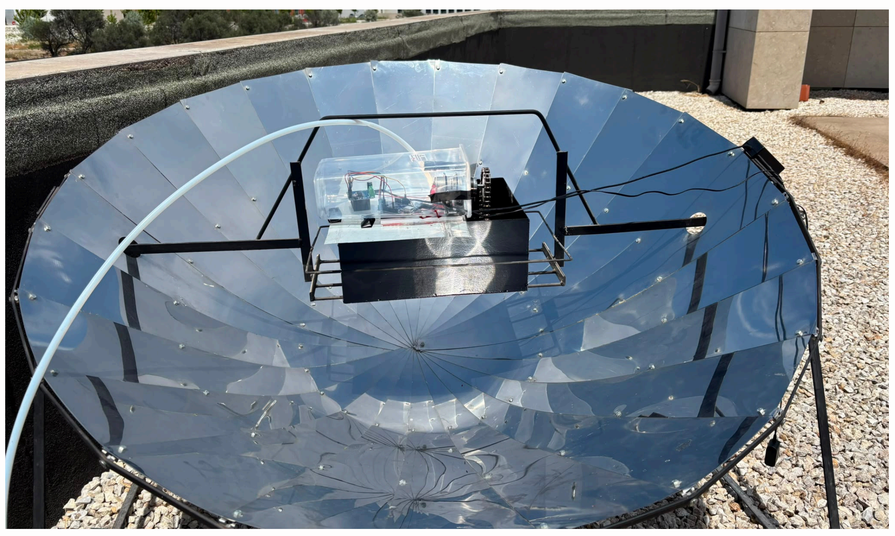


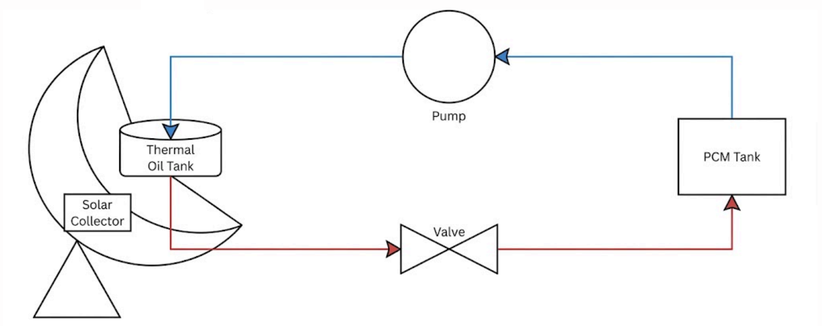
Based on a geometry optimization study (a), an experimental PCM storage system (b) was designed.

Low Temperature:



High Temperature:

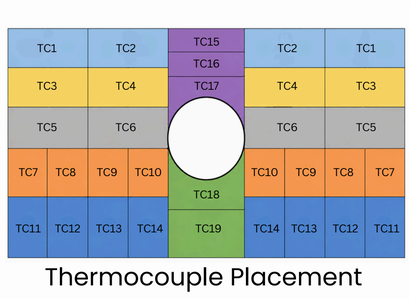




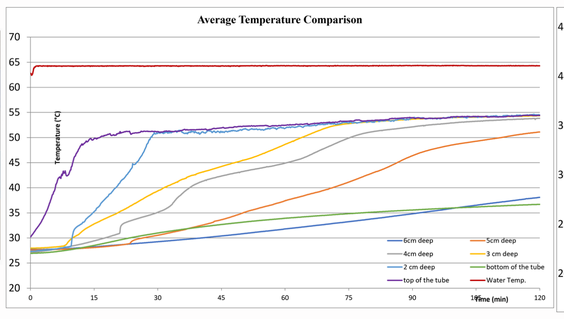
PCM	Type	Melting Temp. (°C)	Latent Heat (kJ/kg)	Application
RT42	Organic	38–43	165	Low-temp. TES
Coral Cornet 159A	Organic	52–62	200	Medium-temp. TES
Erythritol	Organic	118	339.8	High-temp. TES
Solar Salt	Inorganic	220	110–170	CSP & High-temp. TES

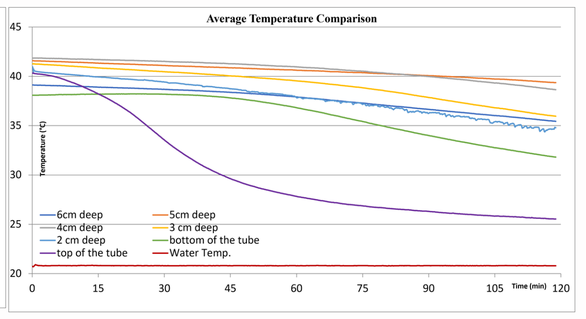
RESULTS

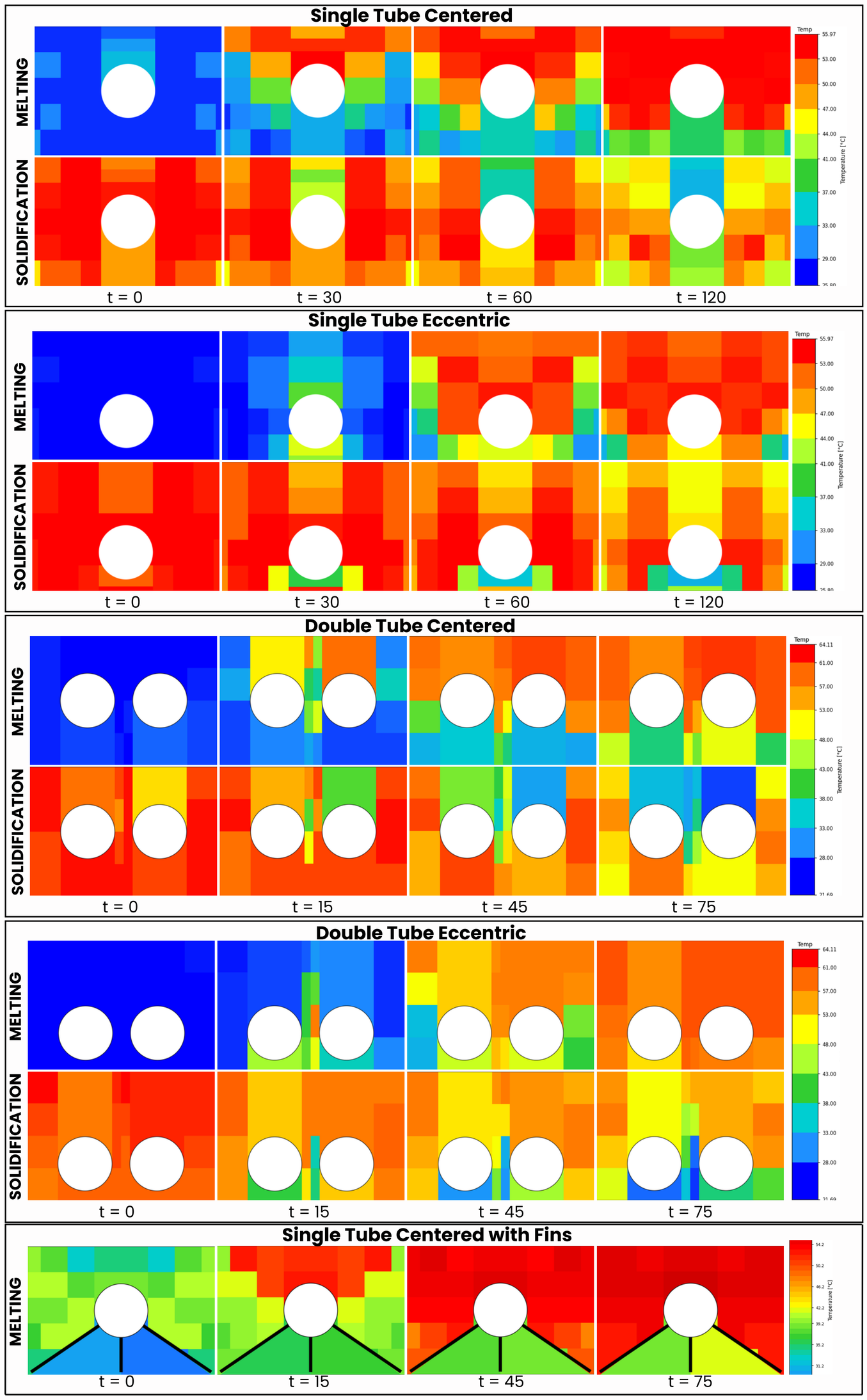
Reference Geometry(Single Tube Centered):



Thermocouple Placement







CONCLUSION

- Experimental results showed similar melting trends with the reference study, validating the reliability of the setup.
- Tube position and PCM domain geometry significantly affected heat transfer distribution during charging and discharging.
- Overall temperature uncertainty was approximately ±1.58 °C.

ACKNOWLEDGEMENT

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