Enhancing Sustainable Environmental Design through Innovative PCM-Based Solutions

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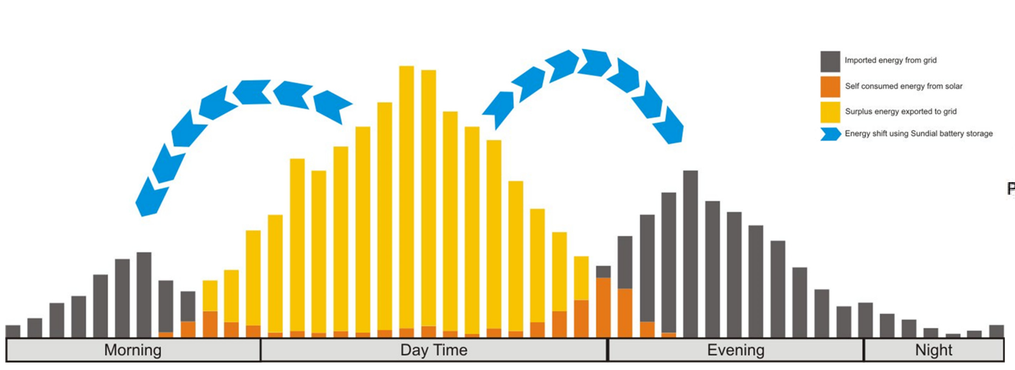
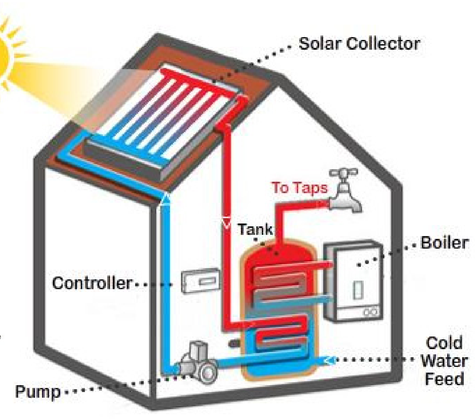
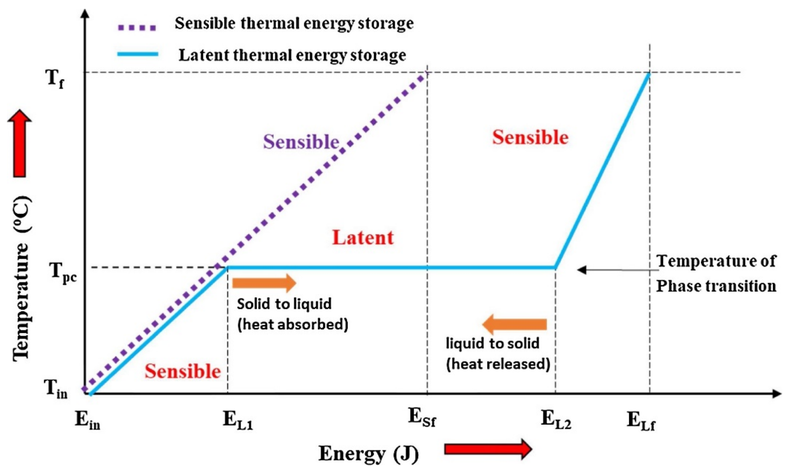
Contextualization

solar energy for production of sanitary hot water

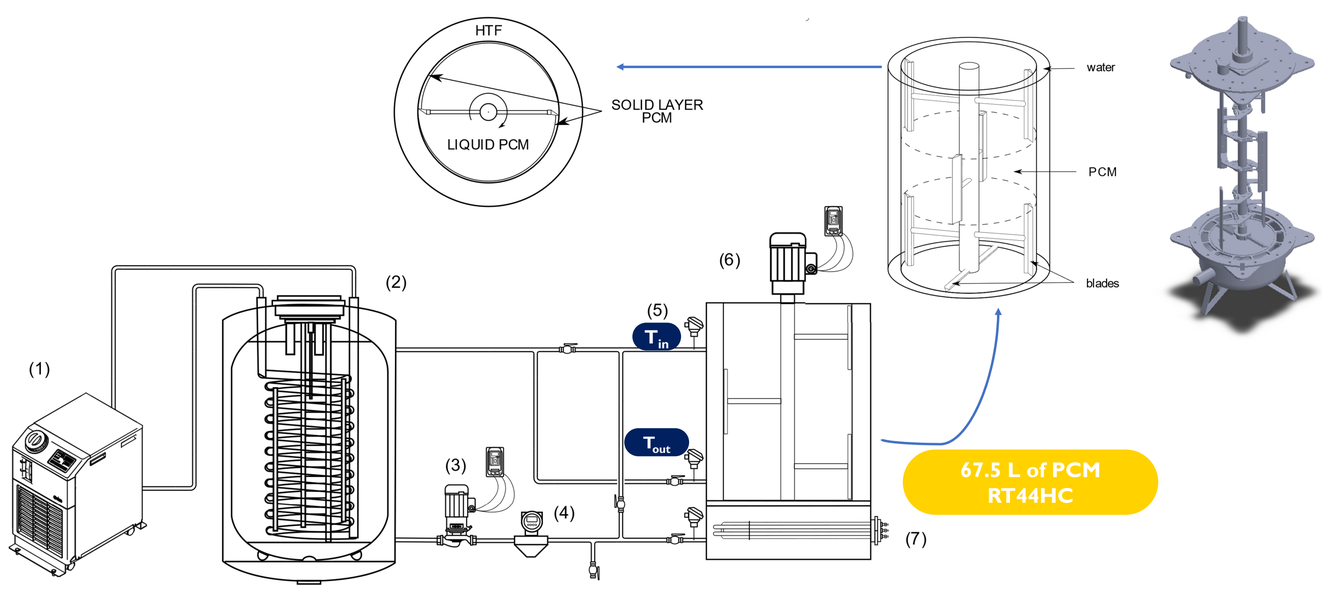




sensible heat *vs* latent heat



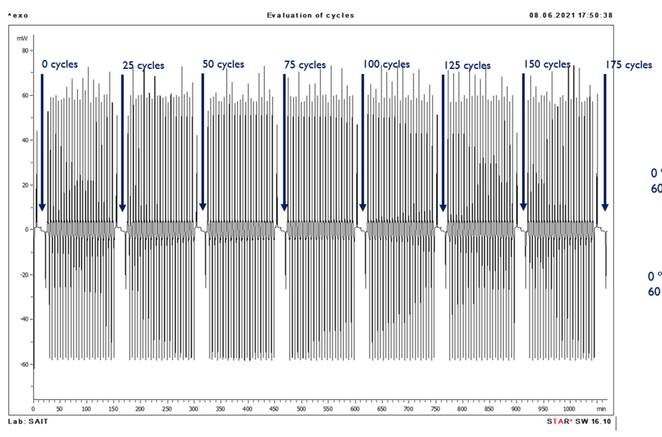
Experimental facility



PCM stability

	Velocity	Scraping time (1 cycle)
Scraper	5 rpm	36 min
Scaled scraper	90 rpm	2 min

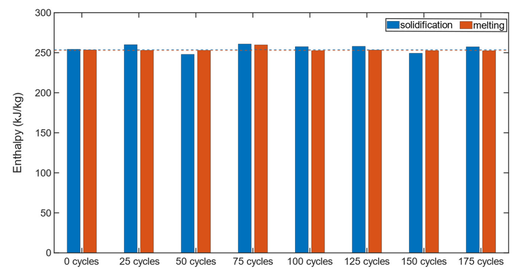
25 cycles ⇨ 50 min
50 cycles ⇨ 100 min
75 cycles ⇨ 150 min
100 cycles ⇨ 200 min
125 cycles ⇨ 250 min
150 cycles ⇨ 300 min
175 cycles ⇨ 350 min



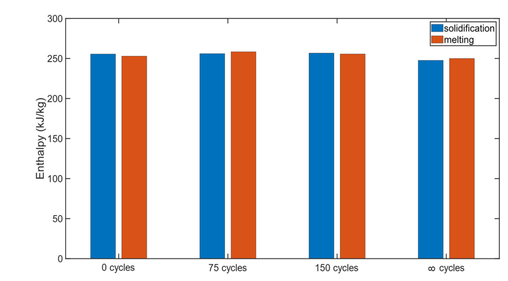
Quick cycles
0 °C / 60 °C ⇨ 20 °C/min ⇨ 60 °C / 0 °C

Slow cycles
0 °C / 60 °C ⇨ 5 °C/min ⇨ 60 °C / 0 °C

Cooling rate: 50 ml/min N_2



PCM no scraped



PCM scraped

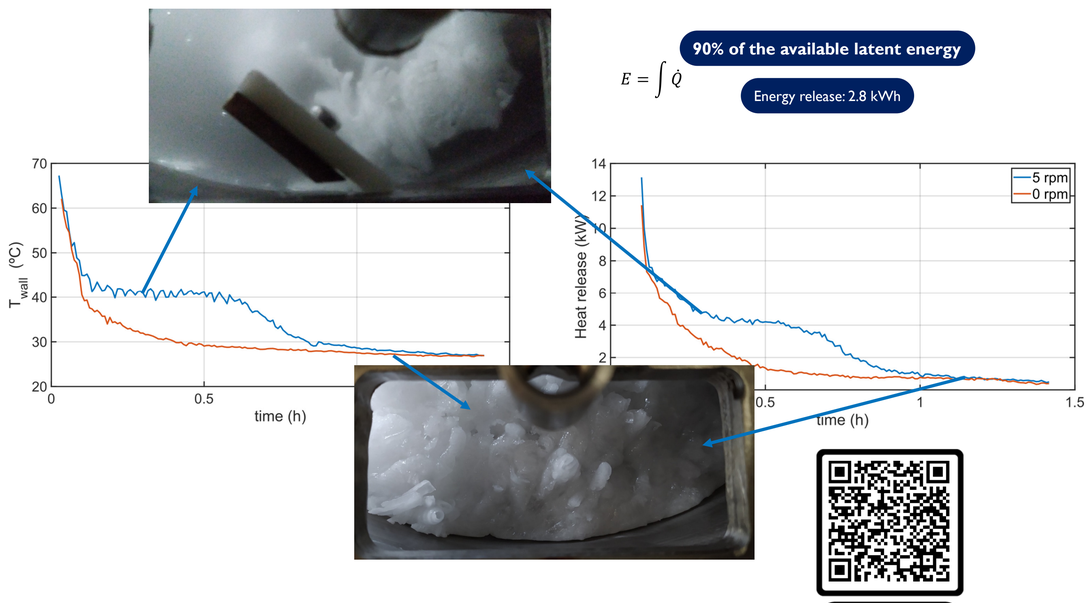
Experimental results

Solidification test: Scraping mode

$E = \int \dot{Q}$

90% of the available latent energy

Energy release: 2.8 kWh



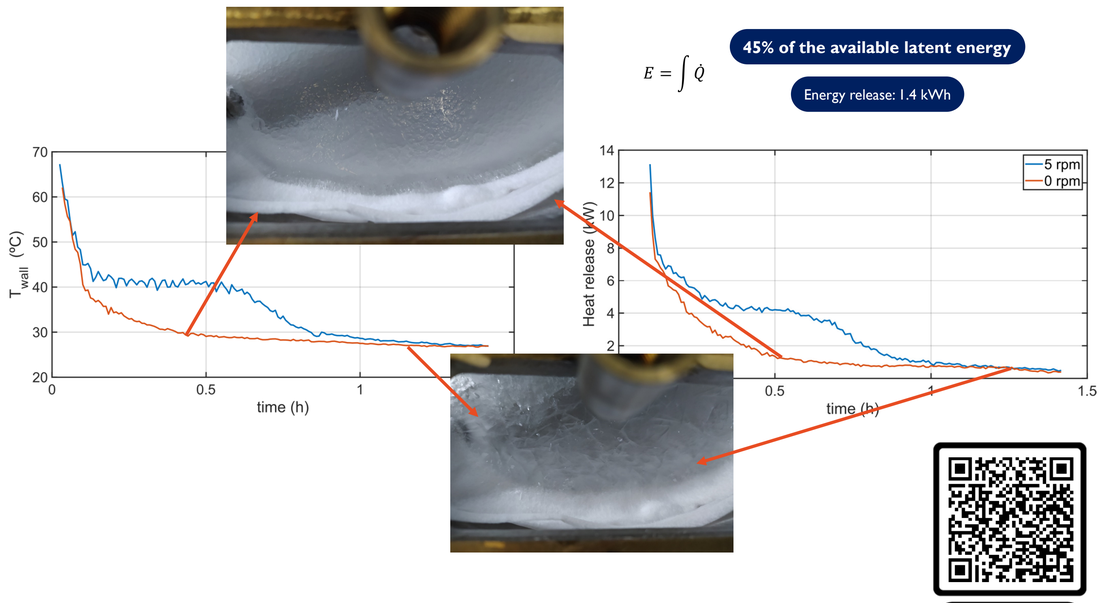
SCAN ME

Solidification test: No Scraping mode

$E = \int \dot{Q}$

45% of the available latent energy

Energy release: 1.4 kWh



SCAN ME

Conclusion

- RT44HC is an adequate PCM for active thermal enhancement techniques.
- Experimental results show up the improvement of scraping in PCM solidification.
- The use of blades to remove solid PCM layer is a promising methodology to extract energy from PCM.