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Evaluation of the Thermophysical Properties of High Temperature Phase Change Materials for Thermal Energy Storage

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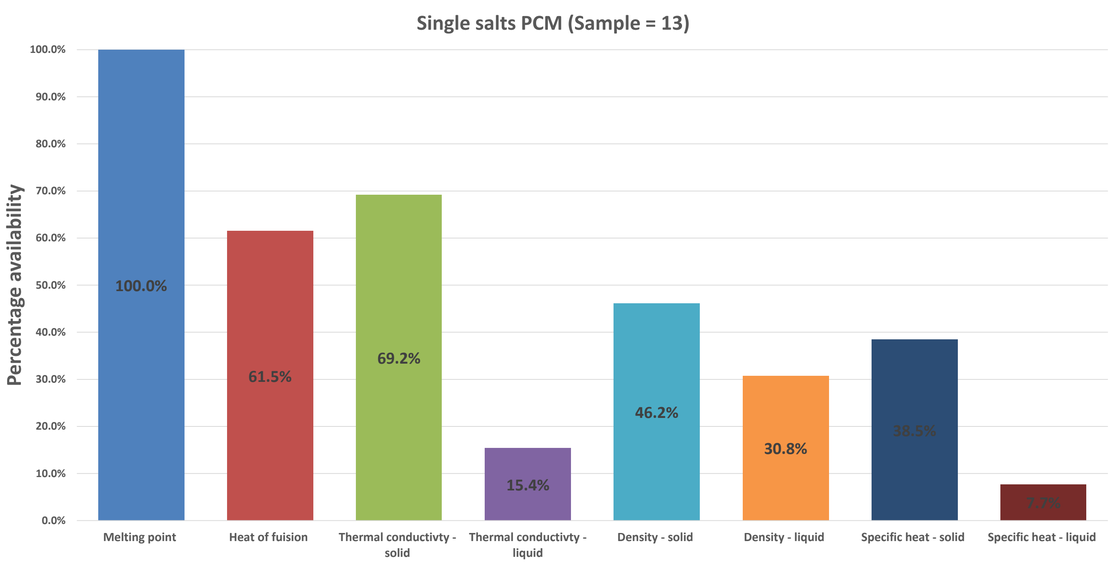
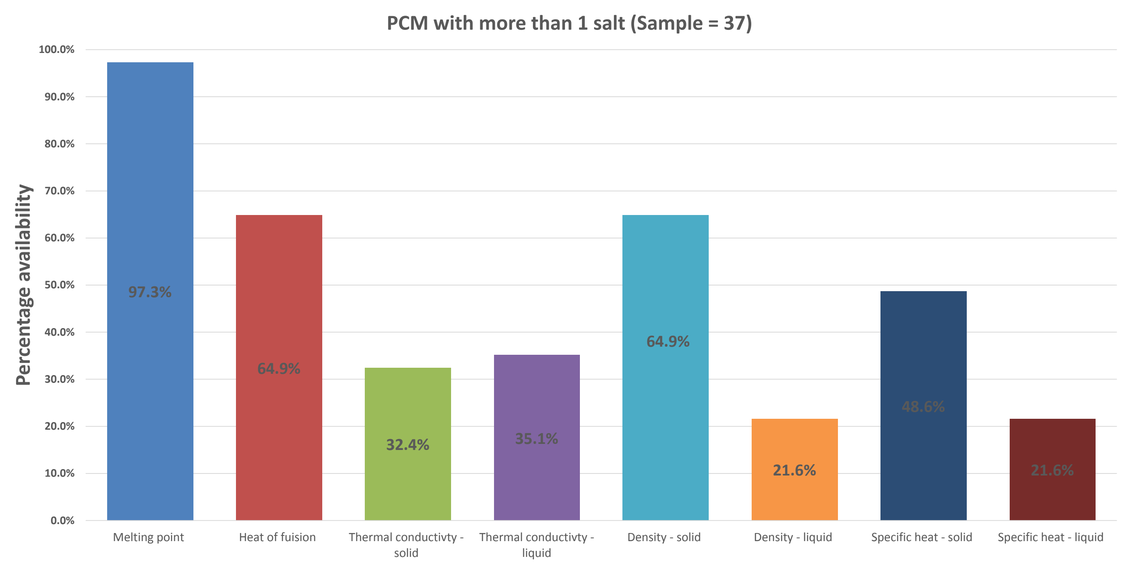
Background

- There is limited data on the thermophysical properties (melting/freezing point, enthalpy, specific heat capacity) of phase change materials between 300 ℃ to 700 ℃.
- Methods of measurement use small test samples (1–10mg), and the data is limited to homogeneous materials.





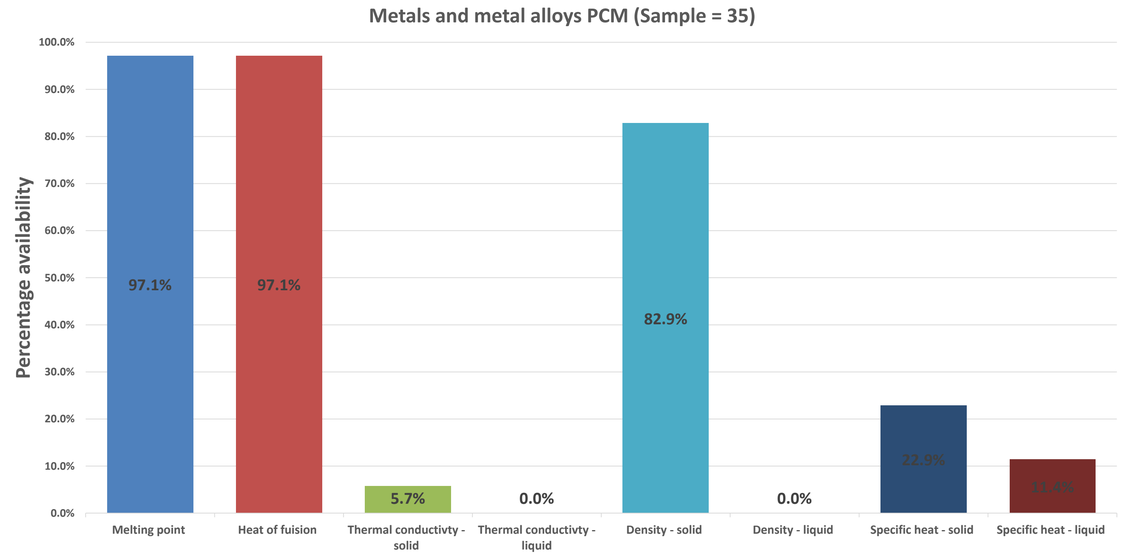


Figure 1: Statistics of the availability of thermophysical properties from existing literature (Omaraa et al. 2015)

Motivation

- PCMs are heterogeneous materials
- Properties of materials may vary with volume (due to subcooling, phase separation)
- Conventional instrument is a differential scanning calorimeter, which measures volumes of around 1 to 10 milligrams
- Other methods such as T-history and calorimeter measure in grams.

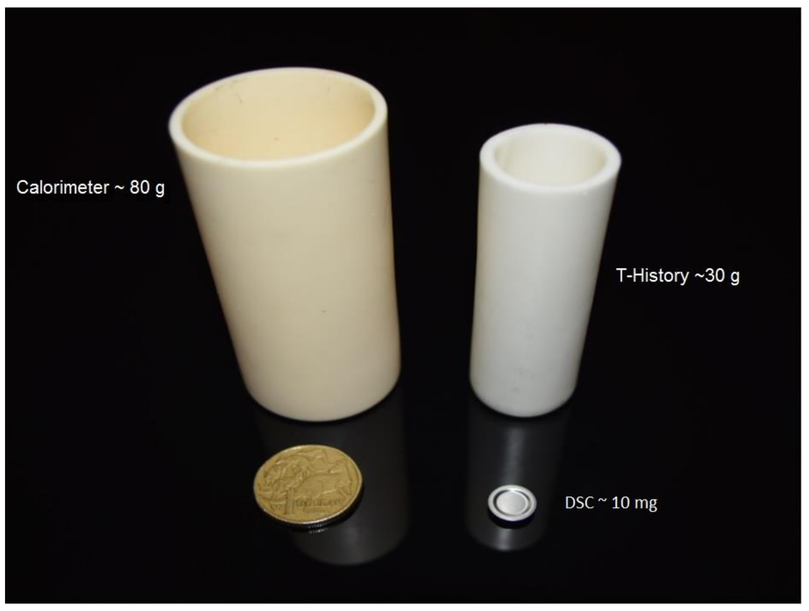
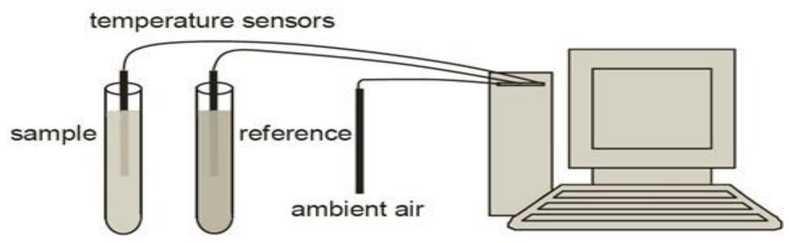


Figure 2: T- History & Calorimeter samples size compared with DSC.

Test Bench



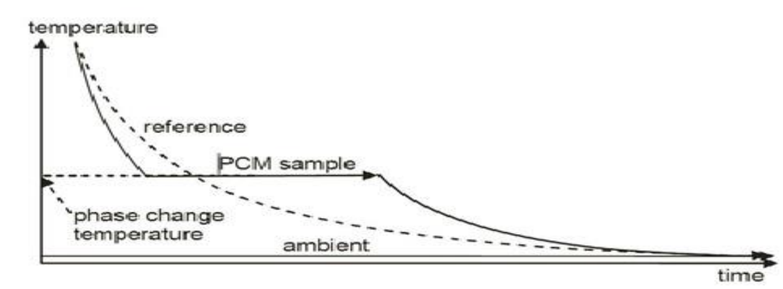


Figure 3: A schematic diagram of T- history (Mehling & Cabeza 2008).

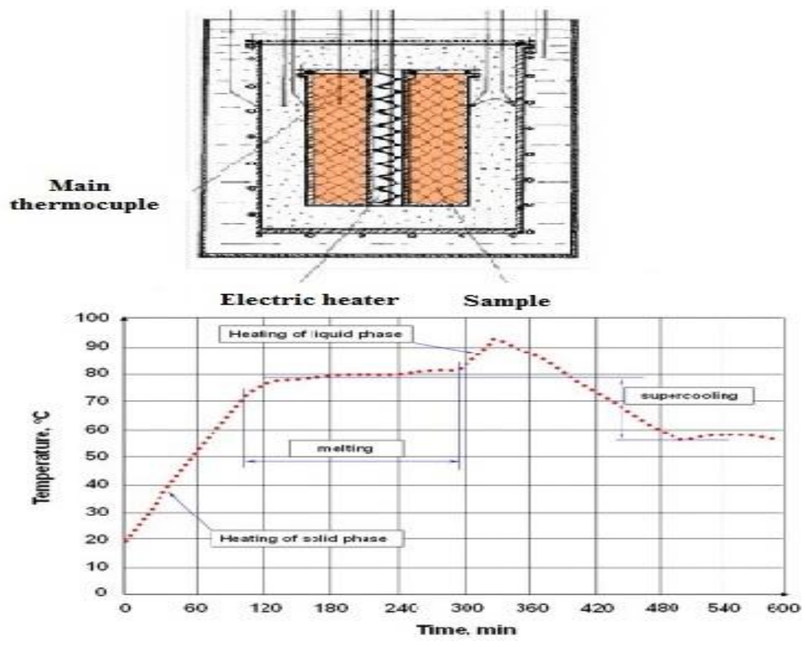


Figure 4: A schematic of the calorimeter (Domanski, Jaworski & Rebow 1995).

Conclusion

The calorimeter and temperature history (T-history) method may be simpler, less expensive and more accurate than current methods.

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REFERENCES

1. Omaraa, E., Saman, W., Bruno, F. and Liu, M., A Review on Thermophysical Properties Data of High Temperature Phase Change Materials for Thermal Energy Storage.
2. Domanski, R., Jaworski, M. and Rebow, M., 1995. Thermal energy storage problems. Journal of Power Technologies, 79.
3. Mehling, H. and Cabeza, L.F., 2008. Heat and cold storage with PCM. Berlin: Springer.

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