

WarmIce

- phase change materials that are similar to, but “warmer” than ice

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27 MAR 2014



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Solar cooling, solar hot water,
predictive control, cold storage



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Solar cooling system simulation



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Cold storage, clathrate hydrate
phase equilibrium



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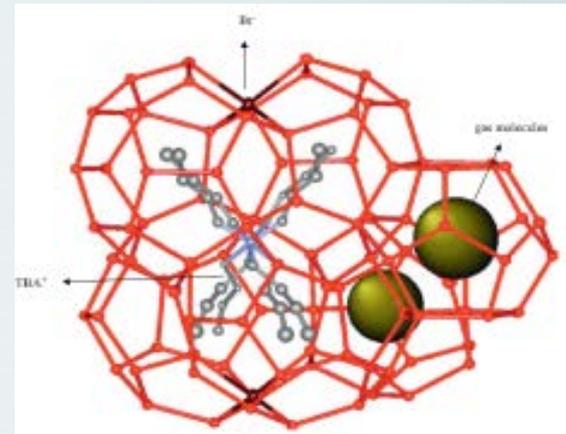
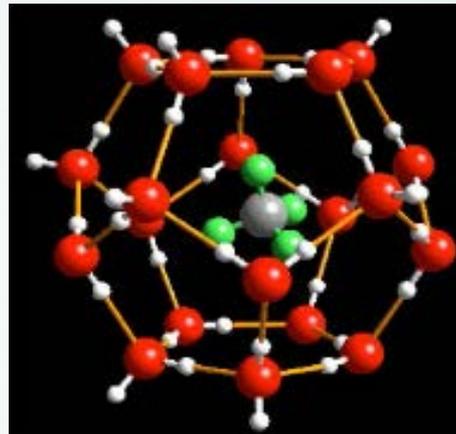
PhD Candidate

Phase change materials and
its application in air
conditioning

What is WarmIce?

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WarmIce is water frozen in an unusual molecular structure such that it freezes at temperatures between 5°C and 12°C .



Applications:

- **For off-peak air conditioning:** to save electricity costs, flatten peak load on electricity grids and enhance the Coefficient of Performance.
- **For solar cooling systems:** to address intermittency of energy supply.

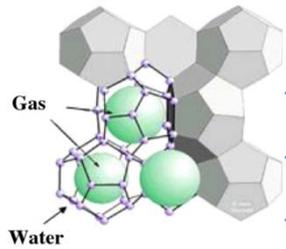
Why WarmIce ?

Why WarmIce ?

Benefit	Example (CO ₂ based WarmIce)	Comparison (with other storage media)
Ideal phase change temperatures - High Coefficient of Performance of the chiller	Temperature range: 5-12°C	Ice: 0°C
High energy density - Small storage size	Dissociation enthalpy: 500 kJ·kg ⁻¹	Ice: 335 kJ·kg ⁻¹ Paraffin C ₁₄ : 228 kJ·kg ⁻¹ Caprylic acid: 148.5 kJ·kg ⁻¹
Low cost	Less than AU\$ 50·kg ⁻¹	Tetradecane: AU\$ 300·kg ⁻¹
Safe	Non-flammable and non-toxic	Acute toxicity, flammable, etc.

Current Research

1. Kinetic and rheological studies of WarmIce

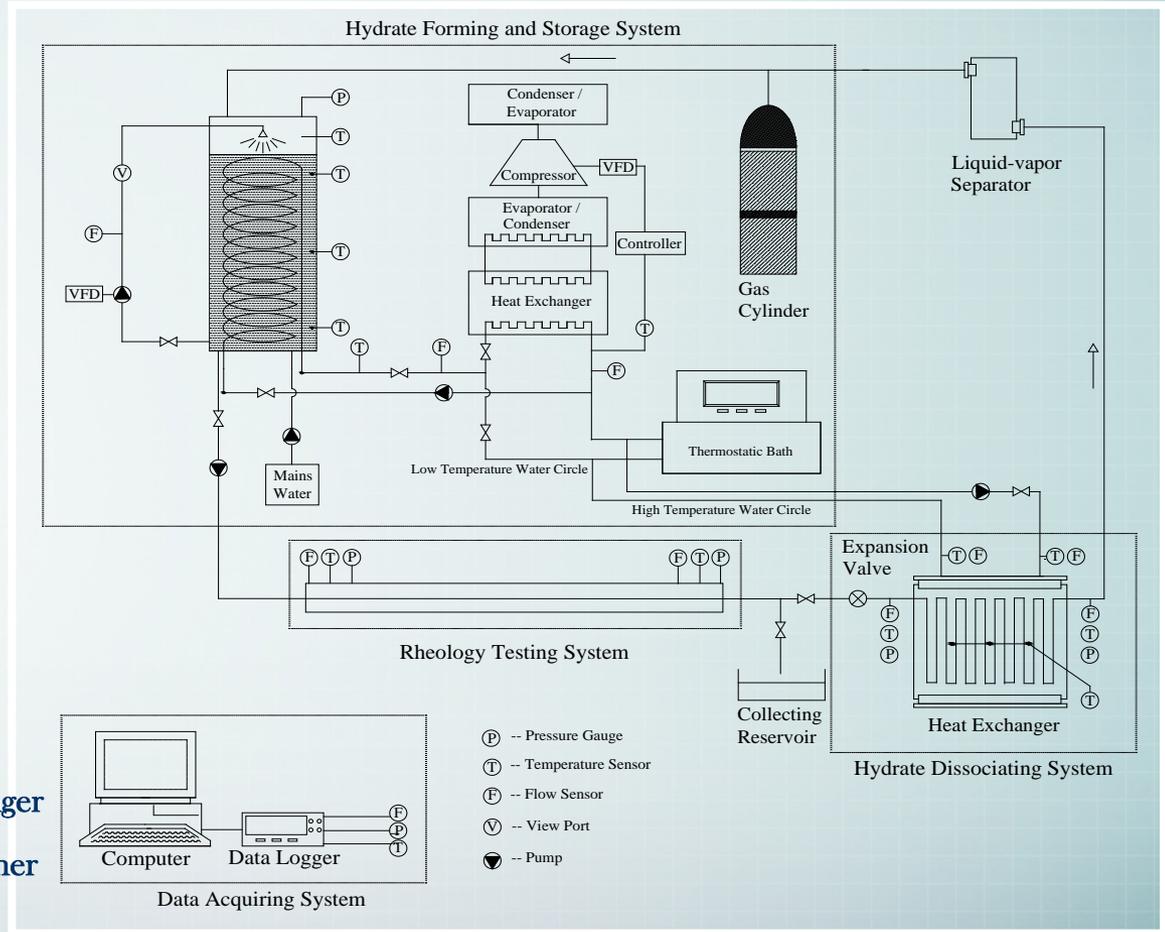


- Formation conditions
- Nucleation
- Formation rate
- Use of additives
- Ice properties

2. Applications of WarmIce in cold storage air conditioning systems



- WarmIce generator
- WarmIce heat exchanger
- WarmIce air conditioner



Schematic diagram of the clathrate hydrate test system



THANKS FOR YOUR ATTENTION!

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