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

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Phase change materials and its application in air conditioning
**What is WarmIce?**

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

**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?

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Example (CO₂ based WarmIce)</th>
<th>Comparison (with other storage media)</th>
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<tbody>
<tr>
<td>Ideal phase change temperatures</td>
<td>Temperature range: 5-12°C</td>
<td>Ice: 0°C</td>
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<td>- High Coefficient of Performance of the chiller</td>
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<td>High energy density</td>
<td>Dissociation enthalpy: 500 kJ·kg⁻¹</td>
<td>Ice: 335 kJ·kg⁻¹</td>
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<td>- Small storage size</td>
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<td>Paraffin C₁₄: 228 kJ·kg⁻¹</td>
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<td>Caprylic acid: 148.5 kJ·kg⁻¹</td>
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<td>Low cost</td>
<td>Less than AU$ 50·kg⁻¹</td>
<td>Tetradecane: AU$ 300·kg⁻¹</td>
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<td>Safe</td>
<td>Non-flammable and non-toxic</td>
<td>Acute toxicity, flammable, etc.</td>
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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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