Thermal Energy Storage for Process Heating

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Industrial Process Heat

- Industrial sector accounts for about 20% of the final user energy demand.
- Most of the energy comes from fossil fuels directly or indirectly.
- Heat is responsible for 70% of final energy demand in industry.
- Among the industrial process heat, about 30% is in the temperature range of 0-200 °C.

Industrial Process Heat

Technologies for recover and re-use the heat:

- On-site heat recovery
- Upgrading the heat for use at a higher temperature
- Conversion of surplus heat to chilling energy
- Conversion of heat to electricity
- The transportation of heat to meet an offsite heat demand.

Problem:

Discrepancy between the heat supply and heat demand.

Thermal Energy Storage

- Sensible heat storage
- Latent heat storage (my research):

Thermal energy storage with phase change materials (PCMs) is an effective way due to its high heat storage density and its isothermal operating characteristics.

- Thermochemical storage

My Research

Aim:

1. Review the available industrial process heat.
2. Test the materials properties, including melting temperature, latent heat, corrosion and thermal stability.
3. Design a system of thermal energy storage with PCMs at a temperature around 200 °C.
4. Experimentally study the heat charging and discharging characteristics with different PCMs.
5. Numerically study the heat storage characteristics to optimise the system operation.

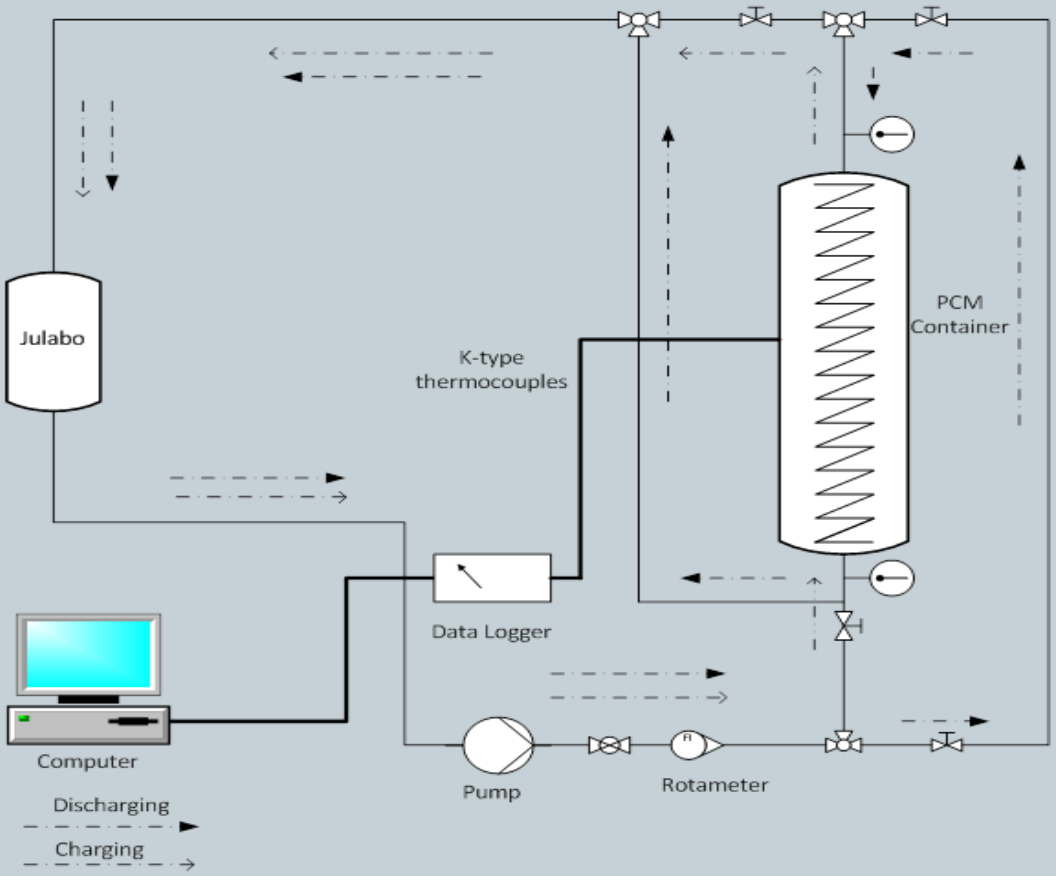
My Research

Materials

Compound	Melting temperature ° C	Latent heat kJ/kg	Thermal conductivity W/m²K	Density Kg/m³
$LiNO_3$+$NaNO_3$ 0.57+0.43	193	248		
$LiNO_3$+$NaNO_3$ 0.49+0.51	194	265		
$LiNO_3$+NaCl 0.87+0.13	208	369	0.7	2355
H190	191	170	0.518	2300

My Research

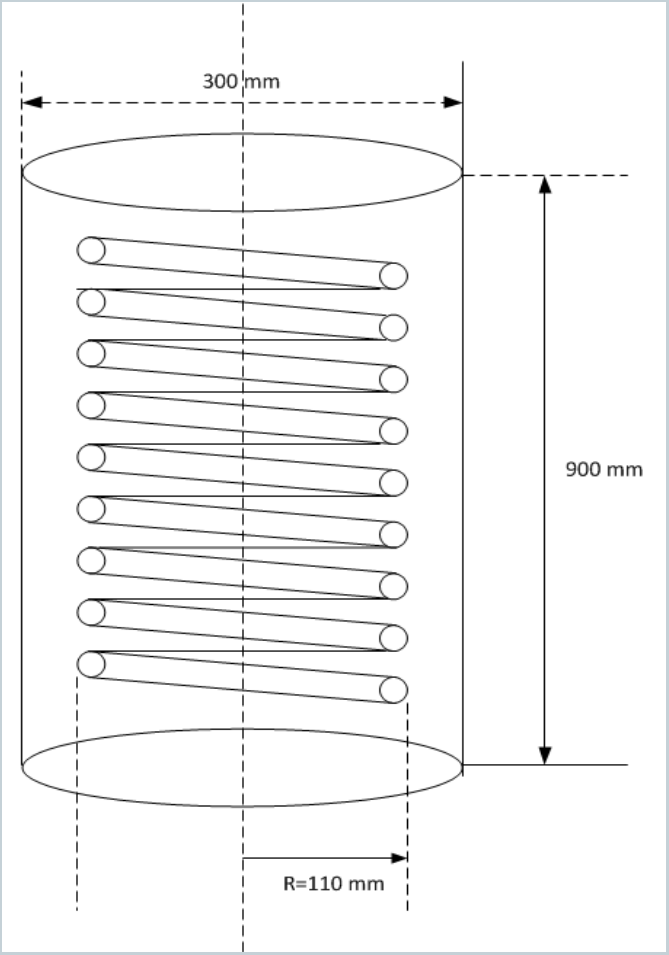
Schematic of the experimental setup



My Research

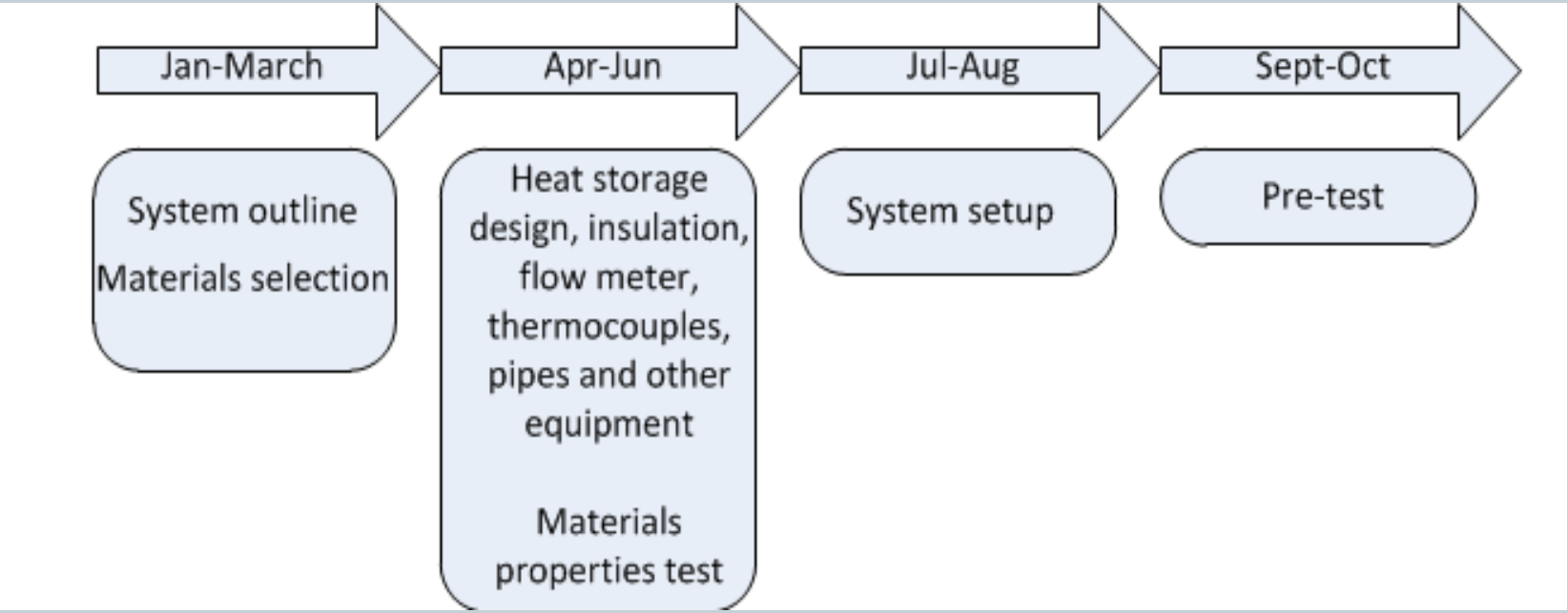
Heat storage container

- Copper made;
- Helical coils with fins to enhance the heat transfer rate;
- Eutectics of $LiNO_3$+$NaNO_{3;}$
- Heat transfer fluid: Julabo H350;
- Charging/ discharging power could be at 3- 4 KW;
- Charging/ discharging time could be at 2-3 hours.



My Research

Timeline for the experiment:



Thank you!