Latent heat thermal energy storage for medium temperature solar thermal power plant

Lab-scale latent heat thermal energy storage at the Thermal Science Lab, Department of Mechanical Engineering

Thermal energy storage technologies can reduce the dependency on fossil fuel by making the solar radiation a viable option for electricity generation through solar thermal power plant. This can be done either by integrating with the national power grid or installing in the non-interconnected electric networks, such as small villages and localities.

We are working on the design, analysis and development of Phase Change Material (PCM) based thermal energy storage system with small scale capacity (~10-100 kWt). These PCM can be used for medium temperature (~300^0 C) solar thermal power plant to extend electricity generation after sunset or remove fluctuations from solar radiation during daytime.

We are also studying thermo-physical properties of phase change material using Molecular Dynamics simulations for developing new/upgrade materials. Several technologies of thermal storage system are evaluated by detailed numerical modeling and experiments have been conducted to compare the thermal performance of the storage systems under different operating conditions.

We are also in the process of development and characterisation of novel, cost effective capsule materials for encapsulation of phase change material. Extensive research on thermal stability to ensure long term operation is also underway. Dynamic modeling of solar thermal power plant is being developed to understand the interaction of storage system with other components in the solar thermal power plant. The model shows that the optimised design of phase change material based thermal energy storage can significantly improve the overall efficiency of the solar thermal power plant and make the solar thermal plant more economical for continuous operation on long term basis. Implementation of shell and tube phase change material based thermal energy storage for National Thermal Power Corporation Limited (NTPC) is planned.

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