Process Know- How for manufacturing of Micro-encapsulated Phase Change Materials (M-PCM)

Technology in Brief:

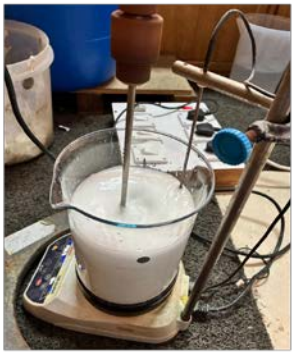
Microencapsulated Phase Change Materials (MPCMs) are advanced thermal energy storage materials in which phase change substances (such as paraffin wax, fatty acids, or eutectic mixtures) are enclosed within a protective polymeric shell. This microencapsulation is typically achieved through in-situ polymerization techniques, forming stable, micron-sized capsules with a core–shell structure.

The primary function of MPCMs is to store and release thermal energy during phase transitions (solid–liquid), enabling efficient temperature regulation. The polymer shell prevents leakage of the PCM, enhances thermal stability, and improves compatibility with various matrices such as building materials, textiles, and coatings.

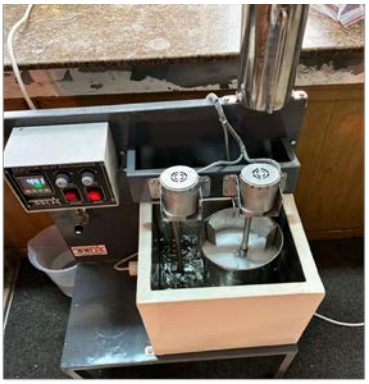
Due to their high latent heat storage capacity, controlled heat release, and durability, MPCMs are widely used in applications like thermal management of buildings, energy-efficient systems, smart textiles, and electronic cooling.

Salient Features/Advantages:

- High Thermal Energy Storage Capacity
- Leakage Prevention
- Improved Thermal Stability
- Controlled Heat Transfer
- Durability under Repeated Thermal Cycling



Preparation of Monomer



PCM Emulsion

Drop wise addition of monomer to PCM Emulsion

M-PCM OP-29

Lab Scale Preparation of Phase Change Materials

Properties & Standards	Thermal energy storage capability, mechanical durability, chemical stability, and cyclic thermal stability
End Product (s)	Microencapsulated PCM powder, slurries, coatings, composites, cementitious composites, and functional thermal management materials
TRL	6
Environmental Impact	Supports energy conservation, reduction in indoor temperature fluctuations, enhancement of thermal efficiency, and sustainable construction practices.
Setup– Equipment required	Agitator vessel with heating arrangement, mechanical stirrer, pH meter, filtration unit/vacuum filtration unit, spray dryer, reaction vessel, temperature control system, and drying setup