

## NANO-ENCAPSULED ORGANIC PHASE CHANGE MATERIAL

### TECHNOLOGY DESCRIPTION

This technology encapsulates the organic phase change material (OPCM), n-alkane into nano sized styrene-methyl methacrylate copolymer shell by one-step mini-emulsion in situ polymerization method.

### TECHNOLOGY FEATURES

This technology was designed to overcome the liquid leakage and low thermal conductivity problem, thus increasing its ability to be used as effective thermal energy storage material. This technology can be used to reduce energy consumption of building, maintaining internal building comfort and can be used as passive or active thermal energy storage (TES) in building.

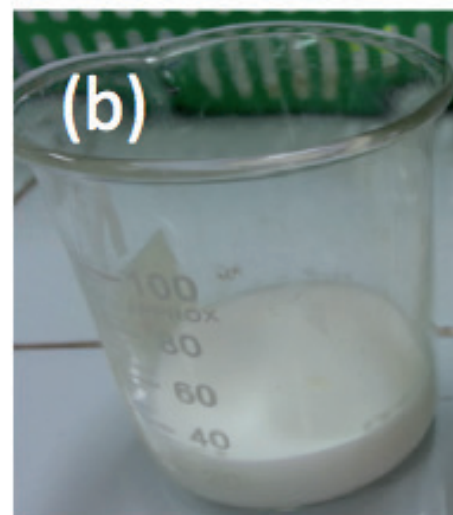
### ADVANTAGES

- Ultra-small diameter – effectively increase the surface area to volume ratio which lead to very high heat transfer speed.
- Provide a space to control the volume changes during phase change process – avoid leakage
- Provide good protection for organic phase change material against external environment during application
- Can be easily incorporated with any matrix
- Increase service time of the organic phase change material

### INDUSTRY OVERVIEW

#### Prospect: Electric and Electronic Industry, Construction companies

The global demand for advanced Phase Change Material (PCM) is projected to reach \$1,472 million by 2019. The growth will be driven by the increasing demand for advanced PCM for building & construction, HVAC, cold chain, thermal energy storage (TES), shipping, packaging & transportation, textiles, and electronics, among others. The estimated portion of construction industry in Malaysia is 5% to 6% of the GDP at the end of 2012, general annual growth rate for construction is 3.7% and share to GDP is 2.9% in 2015. There is job opportunities for almost 1.03 million people that represent 8% of total workforce. The projection is based on the estimation of RM 180 billion of government funded projects, RM 140 billion of private funded and RM 20 billion Public Finance Initiatives (PFI) in this stipulated time frame. The construction industry makes up an important part of the Malaysian economy due to the interaction with other industry branches. The construction industry could be described as a substantial economic driver for Malaysia to achieve sustainable economy. According to the Master plan and 10th Malaysian plan, the government should apply sustainable development's goals in the construction industry.



(a) Nanocapsule in powder form and  
(b) nanocapsules in paste form

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