

The Future for Phase Change Materials

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Current Applications of PCMs in Home Textiles

- Cooling gel foam pad or topper for mattress or pillows provides passive cooling effects.
- The gel absorbs huge amount of heat and hold it until the heat is transported away to the surroundings.
- They all have PCMs!

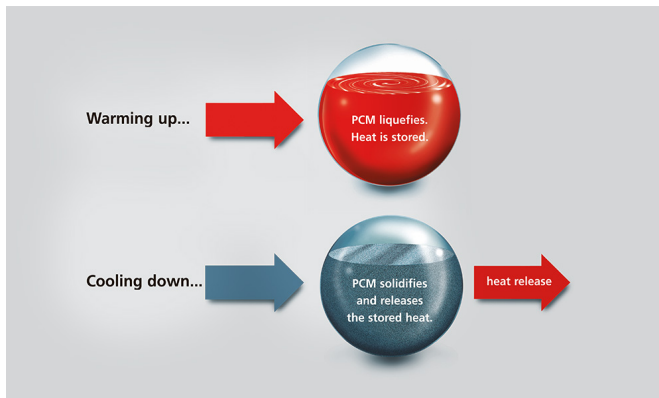
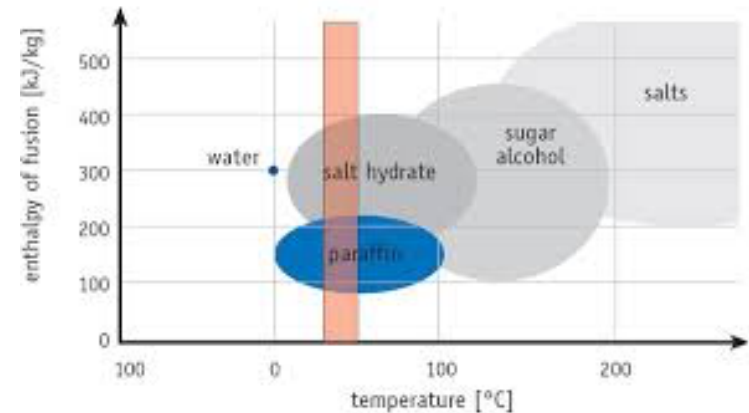


Iso-Cool Side Sleeper Polyester Pillow with Outlast Cover



Sleep Philosophy Flexapedic Gel Foam Topper in Blue from Bed Bath & Beyond

What are PCMs and how they work?

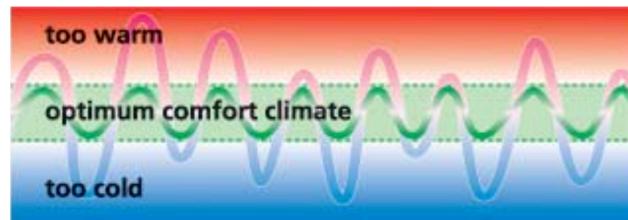


<https://www.schoeller-textiles.com/en/technologies/schoeller-pcm>

- PCMs are those materials that can absorb, store, and release large amounts of energy, in the form of latent heat, over a narrowly defined phase change temperature range, during which the material changes state, i.e. melts or crystallizes.
- The simplest example of PCM is water.
- Most suitable PCMs for making thermo-regulating textiles are those change phase at 18-35°C
 - E.g. Hydrated salts, or Paraffin waxes

PCMs in Thermal Regulating Textiles

- PCMs provide thermal protection over body, and regulate the body skin temperature to improve the comfort.
- PCMs are considered as smart materials that regulate thermal properties, and store and release energy.

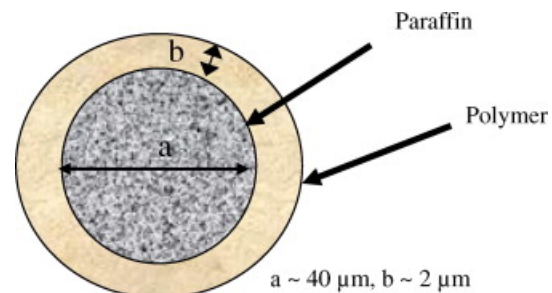
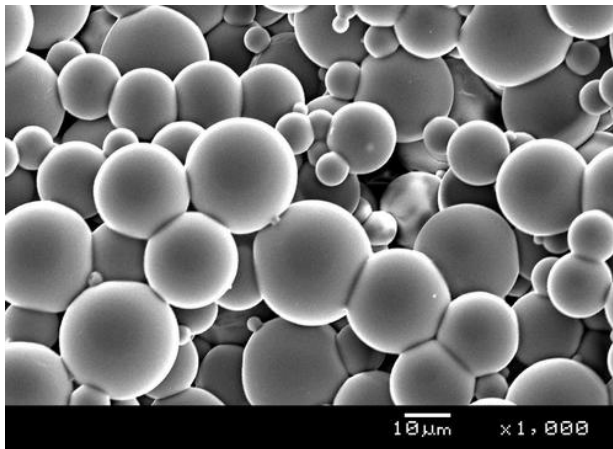
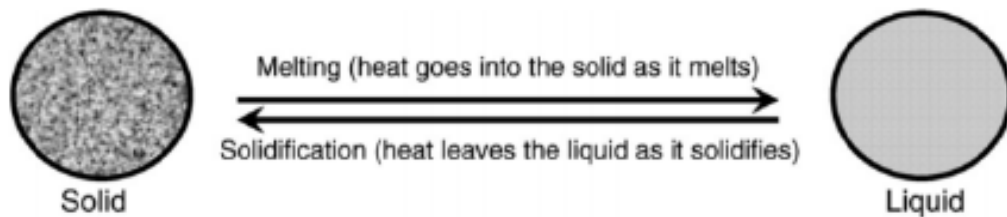


- Applications

- Apparel: athletic wear, protective wear, gloves, helmets, etc.
- Bedding: pillows, mattress pads, sleeping bags, etc.
- Footwear: shoes, socks, insoles, etc.
- Seating: home furnishings, car seats, wheelchairs, etc.
- Other uses: building materials, agrotextiles, packaging materials, medical textiles, aerospace uniform, etc.

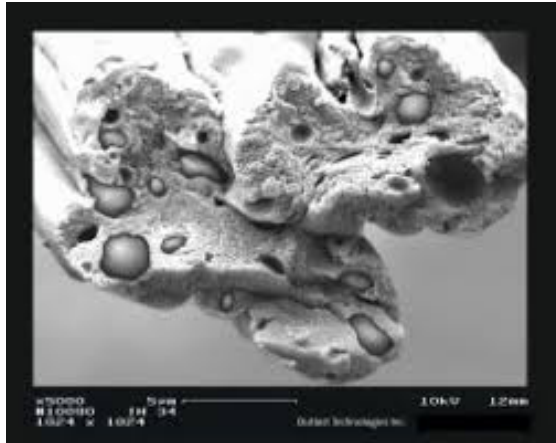
To bring PCMs to textiles – Microencapsulation

- Microencapsulation is an effective way of enhancing PCMs thermal conductivity and preventing possible interaction with the surrounding and leakage during the melting process



To bring PCMs to textiles

- Fiber spinning (doping)
 - PCMs are added into fiber polymer solution.

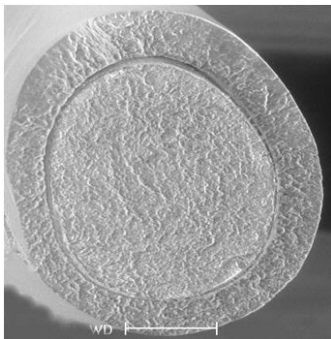


Advantages:

- Permanent effect

Disadvantages:

- PCMs may affect the spinning process and mechanical properties of fibers.
- Low surface contact leads to low heat transfer



To bring PCMs to textiles

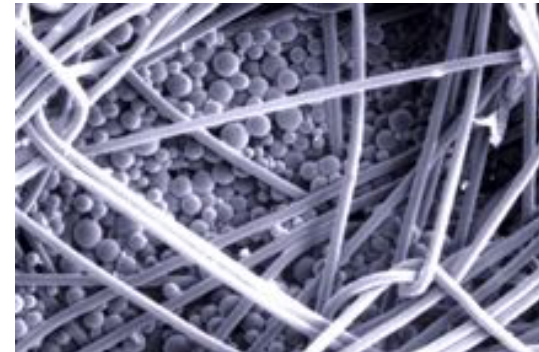
- Coating
 - Microspheres containing PCMs are coated onto textile substrate with a binder.
- Lamination
 - PCMs are incorporated into a thin polymer film, which is then laminated to the inner side of the textile substrate.

Advantages:

- High PCMs concentration per unit area leads to more significant effects.
- Low cost of production.

Disadvantages:

- Stiff hand
- Durability concern



Challenges of PCMs in Textiles

- Limited capacity of latent heat
 - Depending on the type and the load of PCMs on textiles
 - Thin but effective fabrics are not yet available
- Impact on textile properties
 - Hand, air permeability and moisture transmission
- Lack of standards and testing methods
 - EN 16806-1:2016 Textiles and textile products - Textiles containing phase change materials (PCM) - Part 1: Determination of the heat storage and release capacity
 - ASTM C1784 – 14 Standard Test Method for Using a Heat Flow Meter Apparatus for Measuring Thermal Storage Properties of Phase Change Materials and Products

Latest Development



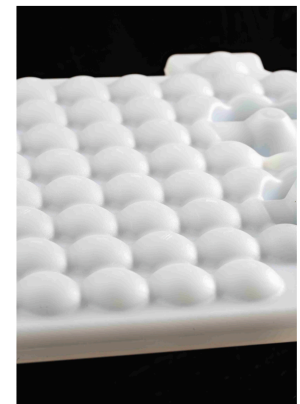
Xelerate by Outlast Technologies
Metallic coating spreads heat faster



Thermofresh® by Pelma S.p.A.
Polyurethane foam embedded
with PCM



Outlast® PCM Fiber by
Outlast Technologies



PureTemp by
Entropy Solutions
Bio-based PCM made from
biodegradable fatty or vegetable oil



TEXTILE TESTING & INNOVATION, LLC

