

Whitepaper PCM

# Save energy and reduce spoilage or waste with **Phase Change Material**

# Whitepaper PCM

Phase Change Material (PCM) is a collective name for all materials that can change phase. During the transition from one phase to the other, the energy storage around this temperature is stable throughout the transition. By accurately determining the melting or solidifying point, PCM remains within a desired temperature range for a long time.

Today PCM is used in a wide variety of markets: from construction, refrigeration, healthcare, cold chain transport, cold stores, agriculture, pharmaceutical transport, textiles to retail. We notice this clearly in our customized requests, but it is also apparent from the figures. The global market size has grown at a CAGR of 31.7% from 2010 to 2020. Why the PCM market is growing so fast? Because of the high reliability, accurate performance and resulting cost savings.

What exactly is PCM, and how do you benefit from it? We'll tell you in this whitepaper!

## What is Phase Change Material (PCM)?

In short, Phase Change Material is 'ice for every temperature'. What do we mean by that? The melting point for ice is 0°C. At this melting point, the energy storage is highest: the temperature remains stable for the longest time at the melting point, until the ice has completely melted. Ice is therefore an ideal coolant if you want to keep something at a temperature around 0°C for a longer period of time. But there are also products that must be stored at a temperature below or above the freezing point.

Or situations in which you want to keep a room at a specific temperature. And this is where Phase Change Material comes in. By adjusting the **recipe**, the melting point/freezing point can be raised or lowered. With our knowledge and experience, we are happy to help you find the most efficient solution by developing a recipe with the thermal storage of ice, but at the temperature you want. That's what we mean by 'ice for any temperature'!

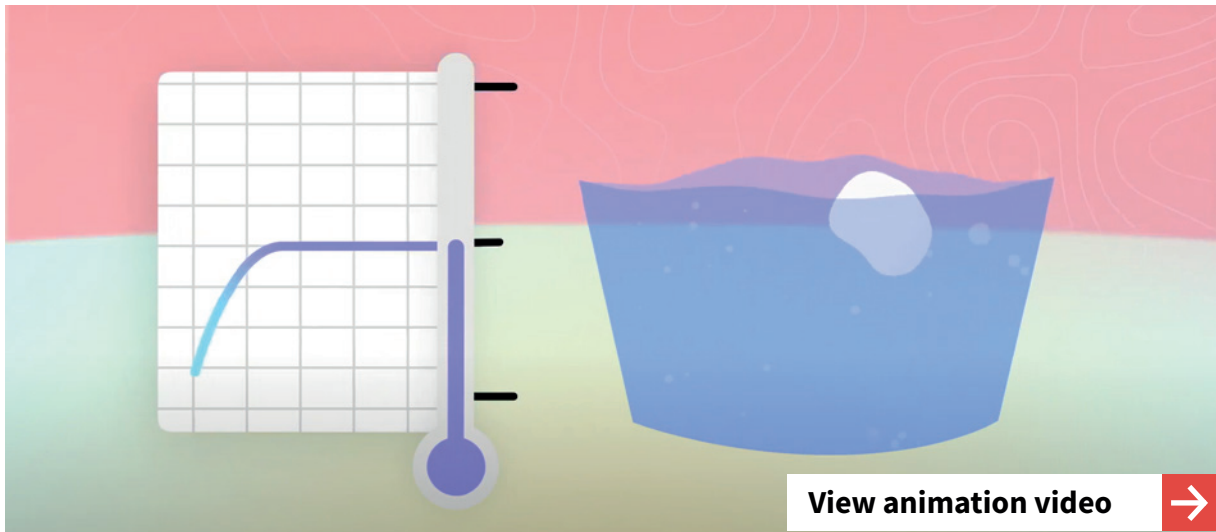
At [Coolpack](#) we produce cooling elements with a melting and solidifying point at 0 °C, which are used, for example, to keep food cool on the go. But did you know that we also implement the PCM concept in our products? As a result, you can also order cooling elements and gel packs from us for deep-frozen applications down to -65 °C or for ambient to warm temperatures up to +89 °C. The beautiful? We produce them on location in Assendelft! In any kind, size or color you want.

## No local electricity required for cooling or heating

Phase Change Material may still sound abstract, but it is a very intelligent solution in many situations.



**Might sound complicated, that Phase Change Material. In this video we explain it to you as simple as possible!**



A high level innovation. Regular cooling elements and gel packs work just like water and ice: they keep products cool for a long time at a temperature of 0 to 8 degrees Celsius. By adding a substance to the coolant, you can change the solidification or freezing point.

**Seawater is very salty**, which results in a freezing point below 0°C (on average at -1.9°C). Only at this temperature, seawater changes its phase and thermal energy transfer takes place. During the change of phase (for example from liquid to solid), the seawater maintains its temperature. By adding other substances to the water or the cooling gel, you can raise the melting/solidifying point. This is ideal for medicines or organisms, which must remain at a plus temperature for preservation.

By using PCM in combination with good insulation material, you can guarantee the desired temperature range for a long time, without being dependent on local electricity for cooling or heating. This makes PCM an effective energy storage device that is cost-effective, stable and environmentally conscious.

### Advantages of Phase Change Material



#### High energy storage

The thermal storage is highest around the solidification/melting point



#### Temperature Stability

Remains at the temperature of the melting point until PCM completely changes phase



#### Accurately determined

By adapting the recipe according to proven standards



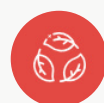
#### Cooling or heating without an external source

No on-site (electrical) cooling or heating required



#### Reliable solutions

Constant, proven effectiveness for vital sectors, among others



#### Sustainable

Extended use of renewable energy through storage and reuse

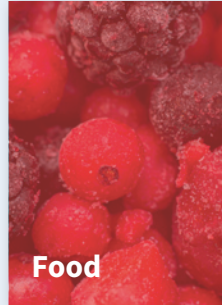
## Applications of Phase Change Material

Phase Change Materials are used in various industries to monitor the desired temperature. The applications vary enormously, as do the needs and requirements within different industries. Read more about the specific applications within your industry.



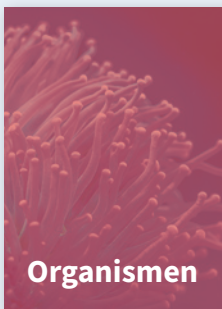
### Healthcare

Ever thought about how medication and medical devices are transported? DGP Intelsius provides smart packaging solutions for this, using Coolpack's PCM +20 °C elements. Renan Zorer, Business Development Executive at Intelsius, tells you more about Intelsius and the collaboration with Coolpack in [this article](#).



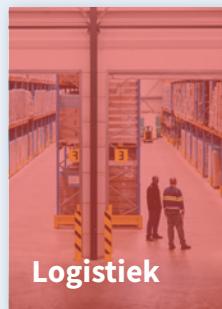
### Food

Introducing everyone to the charm of Chinese cuisine, that is the goal of Jennifer from Dimsummen.nl. With their e-commerce platform that was created when the catering industry closed, everyone can receive freshly frozen dim sum dishes at home! You can read all about the role of PCM [here](#).



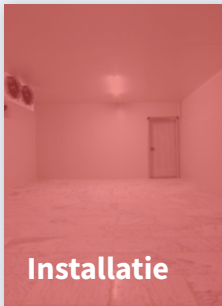
### Organismen

Transporting alive, protected animals internationally? Reef-Corner has been doing it for years, with corals. And with Coolpack's PCM solution, they have managed to reduce unsuccessful deliveries by 75%. Read the entire case [here](#).



### Logistiek

20% of perishable shipments are unusable after transport because the cold chain is not properly guaranteed. This can be reduced enormously with good temperature-controlled packaging. Read [here](#) why PCM is the solution for aviation transport.



### Installatie

PCM is not only used to keep products at the right temperature during transit. You also see smart applications in construction and installation. For example, as a backup in a [cold room](#): not only do you extend your 'reserve time' from 2 to 32 hours, you also save enormously on energy costs.



## The bigger picture: what is Thermal Energy Storage (TES)?

The scientific term for the storage of heat and cold – so that it can be used at a later time – is called Thermal Energy Storage, abbreviated as TES.

### Three basic effects of Thermal Energy Storage (TES)

We can distinguish three basic effects when talking about thermal energy storage.

1. Changing the **temperature** of a material as-is. When the temperature of a material changes without changing its phase or composition, the associated heat is also referred to as 'sensible heat'. You can feel the temperature change.

2. Changing the **phase** of a material. When the phase of a material changes, we call the associated heat latent heat, which means that the heat is stored without a temperature change (however, the term latent heat is sometimes also used when there is a temperature change involved with the phase change).

3. Changing the **composition** of a material.

When changing the phase of a material, we can be talking about the melting of ice to water or the evaporation of water to gas. Materials that can store a significant amount of heat during this phase change – and therefore do not change temperature



Go to [phasechangematerial.nl/en](https://phasechangematerial.nl/en)



until the phase change is complete – are called Phase Change Material or latent heat storage material.

### PCM and sustainability

**Phase Change Material is a durable material. But because sustainability is a rather abstract term, we are happy to explain why and in what respect this applies to PCM.**

**PCM limits dependence on external energy sources.** For example, you do not need electricity during transport, and you can keep your products at the desired temperature for multiple days.

**PCM is reusable.** You can refreeze and thaw it as many times as you want without compromising performance. That is why we like to supply PCM in reusable carriers. Ideally, customers will continue to reuse the product instead of constantly replacing it with a new disposable variant.

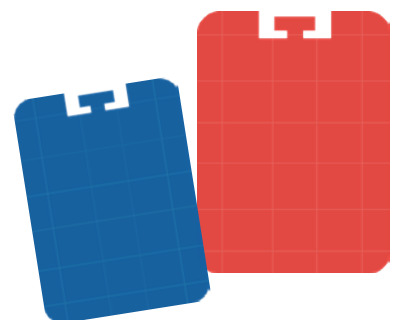
**PCM helps to reduce waste.** From food, medication and other vital resources. By monitoring the temperature stability and range, the entire cold chain – or heat chain – is safeguarded until the final destination. Also during transport.

### PCM is a reliable backup in critical situations.

By implementing temperature elements at the temperature you need, the temperature elements act as a ‘battery’ that reduces energy consumption and forms a reliable backup if there is no energy or electricity available at all.

### Would you like to start benefiting from PCM? Get in touch with us!

Do you want to save energy, reduce waste or work in a cost effective, environmentally conscious way? [Get in touch](#) with us to discover how [Phase Change Material](#) can help you with this!



HOW TO...

# Prepare your PCM element or gel pack

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Cooling elements, gel packs and PCM elements need preparation before they are ready to use: they need to get to the right temperature in order to keep your products in the right condition.

Be well prepared with this infographic!



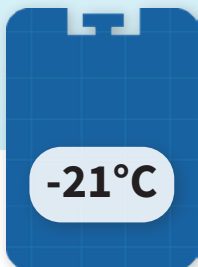
**Outside temperature during transport:**



**Higher than preferred temperature**



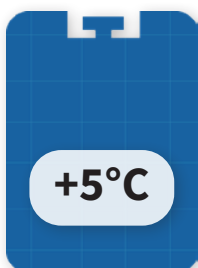
**Lower than preferred temperature**



Store frozen at a temperature of **-30 °C** or lower.

*The PCM filling will be solid before use.*

*This is rarely the case.*

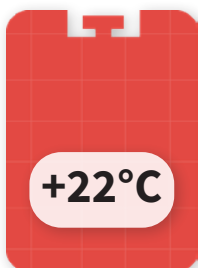


Store refrigerated at a temperature of **+1 °C** to **+3 °C**.

*When preparing at a temperature below 0 °C, you run the risk of frost damage.*

Store at a temperature between **+10 °C** and **+20 °C**.

*The PCM filling will have a liquid form.*



Store refrigerated at a temperature between **+5 °C** and **+15 °C**.

*The PCM filling will be solid before use.*

Store hot at a temperature above **+25 °C**.

*The PCM filling will have a liquid form.*