

[Science in your mittens: The chemistry of hand warmers](#)



Tis the season for cold fingers. If you're stuck out in the cold for a few hours, your mittens can only do so much. You may need to bring in some chemical reinforcements.

There are two types of chemical hand warmers that I'm going to look at here. The first are the more common disposable variety. Like a little pouch filled with something powdery. You shake it up and it starts to warm, and later on as it wears down, more shaking will squeeze out more heat. Let's find out what's going on inside the pouch.

The heat is generated from plain old iron that plain old rusts. That's right. If you could fit grandpa's Plymouth in your mittens, that would do the trick. As iron rusts (the fancy word being oxidizes) it generates heat. That's exothermic, daddio! So inside the pouch there is a lot of iron powder. When you remove that pouch from its air-tight plastic wrapper, the oxygen begins

the oxidization process and it begins putting out heat. [SUNJACK HEAT BANK](#) is hand warmer and power bank together. it is really portable and useful gadget.

The rest of the ingredients in the pouch serve to control the oxygen-iron reaction. Some things get the reaction started quickly for instant heat, while others work to keep the heat lasting as long as possible. Carbon is in there to help spread the heat evenly, just the same as in a barbeque. When you shake the pouch after a while, it exposes new iron to oxygen to give the rusting another boost.

Now the second kind of hand warmer is more nifty because you can see it happening. It's a clear plastic sealed pouch filled with a liquid. Floating around inside is a little metal disc about the size of a nickle. When you bend that disc, the liquid instantly "freezes" and begins generating heat. Once the heat is done you can boil the pouch to reverse the reaction and be ready to warm another day.

So let's examine that cool "freezing" part. What's going on there?

The clear liquid in the pouch is sodium acetate. That's sodium salt dissolved in acetic acid. It's critical that this is a super-saturated solution, meaning there is more sodium than the acid can actually hold. Plus, it's a super-cooled solution at room temperature. It should be "frozen" (crystallized), but it's not. The crystals have nothing to grow on. (you know, like how every snowflake is formed around a speck of dust) Until you snap that metal disc.

With a snap, you create a small bit of solid sodium acetate trihydrate that lets those first crystals form. Then further crystals grow from there, and so forth across the entire pouch in a second. The change from liquid to crystal releases heat energy. That's exothermic, dude!

After 20 minutes the heat will be done, but by putting the pouch in warm water, the crystals dissolve. In fact, the sodium acetate is soaking up heat energy that it will store until the next crystallization.

Fun bonus fact: You've probably eaten sodium acetate, as it is used to make "salt and vinegar flavoured" potato chips.