

THERMOCHROMIC MATERIALS

Chemicals and materials which change colour are fun and useful. In this activity you will handle thermochromic materials.

Equipment

- A selection of thermochromic materials including thermochromic film, smart putty, heat-sensitive spoons and rubber ducks, forehead thermometers, car and radiator temperature sensors
- A hot water bottle and an ice cube bag

The activity

1. Students will be allowed to handle the materials and experiment with placing them on the heat source (hot water bottle) and cold source (ice bag)

Safety:

- Be careful with the hot water keep the kettle out of sight.
- Check the surface temperature of the hot/cold bag isn't too hot/cold
- Don't allow students to keep their hands on the hot/cold bag for a prolonged period

The science

Things appear coloured because they absorb and reflect certain wavelengths of light. When thermochromic materials absorb heat their chemical or physical structure changes so that they absorb and emit different wavelengths of light, and look a different colour.

Many thermochromic products (including the toys, spoons and car temperature sensors) use leuco dyes. These chemicals change from a coloured to a colourless form over a particular temperature range and come in a wide range of shades. They are easy to work with and can be incorporated into lots of different materials including inks, plastics and fabrics. Although often used for novelty items leuco dyes are increasingly being used for safety products (like baby spoons and food labels) and fraud deterrents (e.g. hidden symbols printed on genuine tickets)

The main problem with leuco dyes is that you can't be absolutely certain of the exact temperature they will change colour at. Liquid crystal is more expensive and difficult to work with, but can be engineered to change colour at a precise temperature - ideal for products like forehead thermometers. The thermochromic film, smart putty and so-called 'mood rings' also incorporate liquid crystal.

