

COLOUR CHANGING DUCKS



Thermochromic substances exhibit the property of **thermochromism**, an ability of substances to change colour in response to temperature changes.

The two most important groups of materials exhibiting thermochromism are **liquid crystals** and **leuco dyes**.

Liquid crystals (LC) undergo crystalline phase changes due to thermal expansion in the crystal, resulting in a change of spacing between the crystal layers. This causes a shift in the Bragg diffraction reflected wavelength.

LC find applications where the temperature change has to be accurately displayed. They find applications in room-, forehead-, refrigerator- and aquarium thermometers. They are also used as propane level indicators in gas tanks. The most famous LC application of all times was the "mood ring" of the 70's.

Leuco dyes (also known as "white dyes") allow for a wider range of colours to be used, but their response temperatures are not that accurate, usually in a 3 °C interval.

The colour changing ducks are covered with a layer of leuco dyes. The dyes are used in combination with other permanent pigments and change colour reversibly as the temperature increases.

A wide range of organic leuco dyes are available changing colour between -5 °C and 60 °C.

They see application wherever the sharpness of the temperature change is not that important. Applications are:

- ♦ Novelties such as bath toys, colour changing spoons, mugs and cups
- ♦ Microwave temperature indicators on food packaging
- ♦ Thermal paper
- ♦ Battery status indicators (The Duracell® indicator makes use of leuco dyes applied to a resistive strip indicating the heating temperature of the strip that is related to the battery's current delivery)

Leuco dyes' life span is adversely affected by sunlight (UV), extreme temperatures above 200 °C and contact with aggressive solvents.

For more information: "Thermochromism in commercial products" M A White & M LeBlanc
Journal of Chemical Education, Vol 76, No 9, P 1201, Sept 1999

