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## **Glossary**

Thermochromic dye systems: pigment based microencapsulated slurries that change colour reversibly in reaction to temperature change.

Leuco dye: pigment based microencapsulated slurry that changes colour reversibly from coloured to colourless on temperature change.

Liquid crystal dye: microencapsulated PVA based slurry that changes colour reversibly through a spectrum of colours on temperature change, the traditional colour changes show red, green and blue through the spectrum and are described as 'Colour Play'

Colour Play: a term reported in literature and used by industry experts to describe the spectral colour change exhibited in the liquid crystal dyes.

Microencapsulation: a chemical process that allows substances to be encased in tiny protective shells (molecules). Microencapsulation allows the thermochromic dye systems to be printed on textiles, creating a functional and protected dye system.

Reversible (in terms of thermochromics): the colour-change produced by the thermochromic dye reverts back to original colour when the activation temperature is lowered. The colour-change is non-permanent.

Irreversible (in terms of thermochromics): some types of thermochromic mixtures present a permanent colour-change after they reach their activation temperature. The colour-change is permanent and provides a heat-map.

Dye system: thermochromics are referred to as a dye system as they are more similar to a pigment based textile printing system that is deposited on the surface of the fabric and do not penetrate the fibre like a traditional dyestuff.

Colour-change: describes when a thermochromic colour changes from one colour to another or disappears.

Heat-profile: a term created to describe the heat map generated on the surface of thermochromic fabric by the heat-sink circuits developed for the research.



Heat-profiling circuits: this relates to the PCBs (printed circuit boards) that were produced with heat-sinks in a range of different designs providing the heat-profiles.

Heat-sink: a term used in this research to describe the circuit design, which used a resistor to generate heat, and the sink being the copper shapes that the heat spread into.

Chromic materials: a term used to describe materials that change colour in reaction to different external influences.

Smart materials: a term used to describe materials that have the ability to react in response to an environmental change or stimulus.

Single Colour Liquid Crystals: LCR Hallcrest (manufacturer of temperature sensing devices) are developing single colour liquid crystal mixtures. The basic principle of the mixtures is that they are designed to show a single colour change over their working temperature range and are described as Single Colour Above (SCA) or Single Colour Below (SCB) mixtures.

Phase Change Material (PCM): the function of the material is to store and release heat through encapsulated particles that turn from solid to liquid on heating.

Thermostar Binder: is recommended for use with the Chromazone leuco dye systems on textiles and is supplied by LCR Hallcrest.

Chromazone: the trade name for the range of leuco thermochromic dye systems supplied by LCR Hallcrest.

Response/activation Temperature: the temperature at which the thermochromic mixture is triggered to start to change colour.

LCR Hallcrest: manufacturer of temperature sensing dispersions and temperature indicating devices.

Liquid Crystal Films: are a sandwich of polyester film, liquid crystal and a black backing commercially produced for indicator labels.

Cholesteric liquid crystal: a cholesterol formulation based on the natural liquid crystalline phenomenon seen in cholesterol molecules. Friedrich Reinitzer discovered the liquid crystalline nature of cholesterol in 1888.

Revacryl 275: a textile binder supplied by synthomer that dries with a slight sheen and can be fixed at low temperatures (ideal for combining with liquid crystals).

Chiral nematic liquid crystal: a man-made (synthetic) version of the cholesteric liquid crystal, which is more expensive, however they are reported to provide superior stability and produce a stronger 'colour-play'

Drawdown bar: a method for applying thin coatings of liquid crystal slurry to substrates with a wire wound bar.

Temperature Thresholds: the term relates to the different activation temperatures of the thermochromic dye systems that were made available for the research. The threshold is the temperature at which the thermochromic dye starts to change colour.

Track Resistor: a term relating to the design of stainless steel circuits that use a resistant track within the circuit design.

Resistance: in terms of this research resistance relates to metals, materials or technology that produce heat through resistance. The electrical resistance of a material is a measure of its opposition to the passage of electric current. This opposition causes energy loss as heat to a greater or lesser extent in different materials.

DMX (digital mix system): a term relating to an electronic device that enables digital control of the heat-profiling circuits. The DMX system used within this research is a sprite drive, which has 32 channels that can be individually programmed to provide control.

Variable Power Supply: a DC power supply that allows voltage and current to be adjusted and controlled as needed.

Minco heat pads: commercially available heating device that exploits resistant tracks to provide an even heat.

Temperature sensing system: a system that enabled the Minco heat-pads to adjust their set temperature in accordance to the ambient temperature.

Ethereal: delicate, refined and tenuous, and in this sense it pertains to colour that appears as a delicate entity, only becoming visible through light and structure.

## **List of Publications and Exhibitions**

S Robertson, S Taylor, R Christie, J Fletcher and L Rossini, Designing with a Responsive Colour Palette: The Development of Colour and Pattern Changing Products, *Advances in Science and Technology Vol 60 (2008) pp26-31 Trans Tech publications Switzerland Online @ [www.scitec.ch/3-908158-17-6/26/](http://www.scitec.ch/3-908158-17-6/26/)*

R.M. Christie, S Robertson and S Taylor, Design Concepts for a Temperature Sensitive Environment using Thermochromic Colour Change, *Colour: Design and Creativity*, Issue 1, October 2007 <http://www.colour-journal.org/2007/1/5/index.htm>

Programmable colour-change prototype exhibited at the House of Lords in a follow on event from Made in Future, June 2010

Programmable colour-change prototypes exhibited at Made in Future, Milan, December 2009

Programmable colour-change prototype exhibited at the Smart Textiles Salon, 25<sup>th</sup> September 2009, Ghent, Belgium

‘Where tomorrow begins’ a six month touring exhibition opened at the Scottish Parliament Building on June 2<sup>nd</sup> 2009 show-casing innovations from Universities throughout Scotland: work selected to represent Heriot-Watt University.  
<http://www.wheretomorrowbegins.co.uk/>

A collection of thermochromic textile samples show-cased at Clever Dressing Products and Materials Bazaar, Science Museum, Dana Centre London - September 2008