

Polymers that undergo chromatic transitions based on heating and cooling elements are referred to as being thermochromic and are perhaps the most studied materials in chemical plastic technologies. Spectral data is often used to monitor the changes in these materials to determine suitability for various product applications. These products are created by adding color-changing plastic masterbatches to standard plastic materials during the injection molding or extrusion process to alter the finished product, making it suitable for a variety of applications. By utilizing spectral data, researchers can evaluate the effectiveness of these materials under different conditions forging the way for new technologies such as body temperature monitoring medical supplies, climate data integration equipment, environmentally-friendly building materials, and even practical applications in food service products.

Applications of Thermochromic Polymers

The potential for thermochromic polymers is just starting to emerge. Simple applications such as coffee mugs or bathtub toys can alert consumers to extreme temperatures for extended safety measures. From biological sensors that provide continual feedback on climate temperature changes to smart windows that adjust reflectance and absorption based on energy needs, scientists are on the verge of creating more efficient materials that [conserve energy and reduce the carbon footprint on our planet](#).

However, this technology is still in its infancy and long response times are blamed on the irregular structure and weak molecular interactions that slow the reversibility of these products.¹ [This narrows both the effective temperature range of these products as well as the potential for more efficient and effective applications. Monitoring the spectral data of color changes and their response times allows scientists to make changes to increase product effectiveness, further advancing new technologies.](#)

Polymer chemists are conducting new research in which changes are made to the polymer fibers in order to speed up the thermal transition times. Reports from these studies have shown rapid color changes at extreme temperature levels, expanding the horizon for more large-scale applications of these materials.

Using Specular Data to Monitor Change

Specular data can be used to monitor changes in color, giving more specific information about the structural changes and composition of these materials. As heat disrupts the coplanarity of the polymer², [the changes in color can be measured using spectrophotometric instrumentation. Precise quantification of absorption values in these polymers can be used to monitor even minor changes in appearance as these material responds to heat. As the chemical structure of the plastic is altered, spectral data measurements provide the information needed to create new formulations and patterns for repeatability and product effectiveness.](#)

Other Applications of Spectrophotometry in Plastics

Plastic production is on the rise as better technology and more efficient materials continue to be developed. Ongoing research and product design to utilize spectral data and color technology not only helps manufacturing and quality control of current products, but also allows companies to take part in new product development. Spectral data offers information for color matching in plastic materials, which in turn has led to other [new technologies that aid in recycling and conservation efforts](#). [By utilizing spectral data, manufacturers and processing plants can monitor clean and safe raw materials to ensure final product specifications and safety regulations are met.](#)

The aesthetics of plastic color are dependent on spectral data for maintained consistency and product quality. Among consumers, color perception is crucial when making purchasing choices, so many packaging materials must stand apart from the competition. Spectrophotometers are needed to maintain consistency in products colors from batch-to-batch, keeping items consistent and buyers happy.

Spectral Data and Instrumentation

Whether working towards new developments in chemical plastic technologies or maintaining quality control in polymer product development, spectrophotometry offers the tools needed for precise spectral data and monitoring. Spectrophotometers come in a variety of options, each designed to meet specific production and manufacturing needs. From small hand-held devices to in-line process monitoring instrumentation, choosing the right tool is crucial in maintaining accurate and effective results.

Full article with photos available here:

<https://www.hunterlab.com/blog/color-plastics/color-changing-plastics-applying-spectral-data-to-new-technology-development/>