AIT Research

THE DEVELOPMENT OF NOVEL SMART COLOUR CHANGE POLYMER MATERIALS VIA VARIOUS MELT PROCESSING TECHNIQUES

Author: Ms Colette Breheny, Supervisors: Dr Luke Geever & Dr Joseph Geever

Abstract

Smart polymers or stimuli-responsive polymers undergo large reversible changes, whether physical or chemical, in their properties as a consequence of small environmental variations. They can respond to a single stimulus or multiple stimuli, such as temperature, pH, electric or magnetic field, light intensity, biological molecules, etc., that induce macroscopic responses in the material. This project will consider the development of novel smart colour changing polymers via various melt processing techniques, including injection moulding, extrusion and blow moulding.

Introduction

This study will undertake a comprehensive study in the area of smart polymers and to build upon research in the area of melt processing smart temperature (see Figure 1) and photosensitive polymers carried out by Dr Luke Geever and his team (The Smart Polymers Research Group).

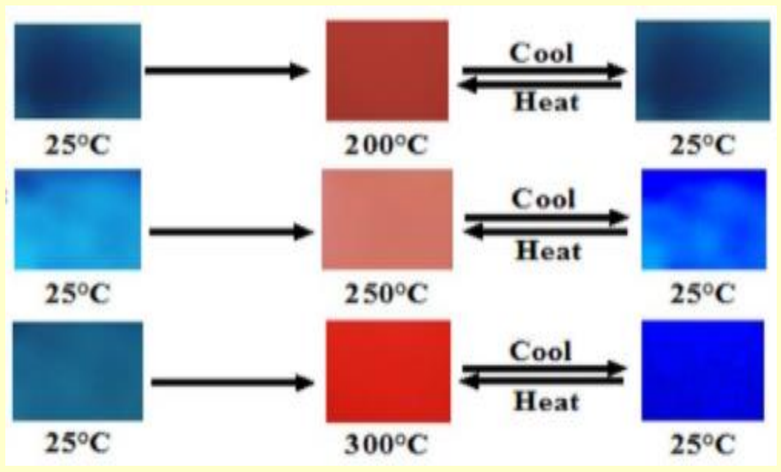

*Figure 1: Reversible Thermochromic Colour Changes **

Aims of the Project

1. To undertake a comprehensive study in the area of smart polymers.
2. The development of novel smart colour change polymers via various melt processing technique.

Objectives of the Project

1. To fully comprehend the thermal transitions and mechanical properties of the novel smart polymers and polymer blends using different melt processing techniques.
2. To gain an understanding of the interaction of novel smart polymers with various polymer materials.

Main objectives of the Research

1. To build upon research in the area of melt processing smart temperature and photosensitive polymers carried out by Dr Luke Geever and his team (The Smart Polymers Research Group).
2. To investigate the potential applications of thermochromic and photochromic polymers.

Key Research Objectives

1. Selection of idyllic loading of smart polymer masterbatch with appropriate polymer material and suitable melt processing technique.
2. Larger scale polymer processing and incorporation of additives.
3. In-depth characterisation and testing.

Collaborations

Higher Education Institutions

Industry Leaders

Smart Polymers Research Group, AIT

Methods

1. Fourier-transform infrared spectroscopy (FTIR): To determine the chemical compounds of the samples.
2. Differential scanning calorimetry (DSC): To determine the exact melt temperature of the samples.
3. Melt Flow Index (MFI): To determine the flow of material under melt.

Melt Processing

Melt processing trials have been carried out using the extrusion process (see Figure 2) and the injection moulding process.

Figure 2: Extrusion of Thermochromic Masterbatch and Polypropylene

References

* Huo, Jingpei, et al. “High Temperature Thermochromic Polydiacetylenes: Design and Colorimetric Properties.” *Applied Surface Science*, vol. 423, Nov. 2017, pp. 951–56. *ScienceDirect*, doi:10.1016/j.apsusc.2017.06.198.

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