PEPT-Flow

An Innovative Polymer Flow Visualisation Technique

Summary

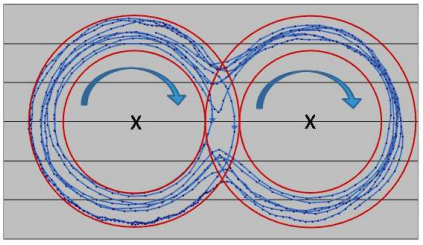
The PEPT-Flow project applies the flow analysis technique of positron emission particle tracking (PEPT) for the investigation of polymer flow and mixing behaviour within industrial twin-screw processes, determining the influence of machine design, process operation and polymer system.

The results generated will be used to:

Aid machine design
Offer operation guidelines
Develop new simulation software
Add to existing modelling programmes
Improve mixing and process efficiency
Obtain energy reductions

Benefits available from PEPT-Flow

- The PEPT-Flow technique has enabled us to visualise more accurately the flow of polymer within given screw geometries. An extremely large amount of data has been generated and detailed analysis is currently underway.
- So far, we can record average residence time and residence time distribution within a given screw element, as well as observing the changes made when differing levels of restriction are placed downstream of the element.
- We can also calculate velocity, and to a lesser accuracy, acceleration of the particle during its progress along the axial component of the screw. One objective is to use this data to quantify distributive and dispersive mixing.



Cross section of 27mm extruder viewed from the die side showing particle trajectory whilst traversing a set of kneading paddles. The superimposed barrel diameter and screw root diameter give an indication of the accuracy of the technique.

PEPT FLOW

SIXTH FRAMEWORK PROGRAMME

www.peptflow.com

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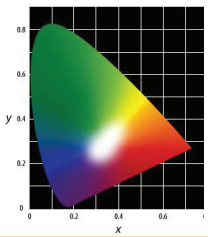
Case Studies

A range of case studies have been developed to illustrate the improved knowledge of the mixing process within the twin screw extruder obtained by the PEPT-Flow studies.

Case studies include:

Pigment Dispersion

Investigation of the influence of screw design on the dispersion and distribution of different colourants.



Blends

Correlation of the dispersive and distributive mixing quality of incompatible polymer blends with the kinematic of the tracers tracked along the PEPT window section.

Wear in Extruders

Assessment of the effects of wear to screw elements by recording the behaviour of tracer particles and comparing new elements with artificially worn elements.

Conductive Materials

This study will compare the mixing efficiency of the production process currently used to compound electrically conducting polycarbonate grades used for production of fuel cell elements.

Flame Retardants

Optimising dispersion of white phosphorus flame retardant without damaging the carbon nanotubes in the formulation, which would ruin electrical properties.

Microwavable Container

Increasing the vicat softening temperature on a PS microwave packaging in combination with SMA.

Scale-up

This case study will compare predictions from modified Ludovic software on two different sized machines and hence gain information on scale-up.