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INJECTION AND BLOW MOULDING OF FIBRE-REINFORCED THERMOSETS AND THERMOPLATICS WITH OPTIMIZED FIBRE LENGHT AND MECHANICAL PROPERTIES

Fact Sheet

Project Information

INBLOFIL

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Project closed

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No data

Coordinated by
Krupp Forschungsinstitut GmbH
Germany

Objective

The aim of the project is to investigate fundamental principles and to modify well-known processing steps and to make it possible to use reinforcing fibres in lengths of approx. 10mm for polymer matrices in injection and blow moulding.
The aim of the project is to investigate fundamental principles and to modify well known processing steps and to make it possible to use reinforcing fibres in lengths of approximately 10 mm for polymer matrices in injection and blow moulding.
Fundamentally the breakage of fibres in polymeric compounds has been investigated in capillaries, dies and couette flow as a function of processing and compounding parameters. The behaviour of fibres in a couette flow has been visualised using fluorescent fibres in transparent model fluids. Using these results, properties of the compound, design of the injection moulding machine and processing conditions have to be optimised in order to reduce fibre breakage. For thermoplastics, fibre melt impregnation and the directly following moulding step in the same heat has been one main activity. Several machines were tested and compared for their suitability. The best results (6-7 mm average fibre length) were achieved with a z-kneader. An automated method to determine fibre length and orientation has been developed. After elaboration of a specimen preparation technique and a measuring device, using an image processing system, fibres of up to 25 mm, even crossed or curved, can be detected and measured.

Research was carried out in order to investigate fundamental principles and to modify well known processing steps for the volume production of (glass) fibre reinforced composite components with long fibres (in the magnitude of 10 nm) in the final component.

Some fundamental investigations into flows occurring during the process and into different influences on fibre attrition were undertaken. The fundamental investigations were performed using experiment capillaries, dies and a melt couette apparatus. Since knowledge of the length distribution of fibres in fibre reinforced plastics is of decisive importance, a computer assisted automated fibre length measurement system was developed. Fibres with lengths up to 25 mm can be detected and measured by means of an image analysis system, even when they are crossed or curved.

Looking at the extrusion blow moulding process for the production of technical hollow articles with long glass fibre reinforced thermoplastics, different ways of fibre impregnation were investigated. Knowing that most of the fibre attrition takes place in the melting step of the polymer, a process was looked for to compound the fibres with the already molten matrix. After testing and comparing different machines a sigma or Z-shaped blade kneader proved to offer the best results. This mixer was integrated into a standard blow moulding machine. With the machine configuration average fibre lengths of above 7 mm in the final component could be reached.

A new concept for a melting binder compound was developed. The glass fibres are protected against fibre breakage by keeping them together with a melting binder. The processing temperature is not raised above the melting point of the binder until the last zone has been reached, so that the fibre bundle dispersion and start of the fibre attrition is delayed until then.
Fundamentally the breakage of fibres in polymeric compounds has been investigated in capillaries, dies and couette flow as a function of processing and compounding parameters. The behaviour of fibres in a couette flow has been visualised using florescent fibres in transparent model fluids. Using these results, properties of the compound, design of the injection moulding machine and processing conditions have to be optimised in order to reduce fibre-breakage.
For thermoplastics, fibre melt-impregnation and the directly following moulding step in the same heat has been one main activity. Several machines were tested and compared for their suitability. The best results (12-13mm av. fibre length) were achieved with a z-kneader. Combination of this kneader with a blow-moulding device will be investigated next. An automated method to determine fibre length and orientation has been developed.
After elaboration of a specimen preparation technique and a measuring device, using an image processing system, fibres of up to 25mm, crossed or curved, can be detected and measured. Optimisation of fibre preparation and handling is still going on, as is the elaboration of a technique to determine fibre orientation.

Fields of science (EuroSciVoc)

natural sciences > chemical sciences > **polymer sciences**

engineering and technology > **materials engineering**

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