MODELLING THE FIBRE-DEGRADATION DURING COMPOUNDING OF SHORT FIBRE REINFORCED COMPOSITES BASED ON GLASS FIBRES AND POLYPROPYLENE

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The glass fibre length resulting and the distribution of the glass fibre lengths are influenced by different process conditions during the compounding on a co-rotating twin-screw extruder. Amongst others these are the screw speed, the throughputs, the processing temperatures, the machine configuration and the properties of the glass fibre chosen. In a joint research project funded by the DFG (Deutsche Forschungsgemeinschaft) between the SKZ (Sueddeutsches Kunststoff-Zentrum) and the KTP (Kunststofftechnik Paderborn) a physical-mathematical model was developed which describes the glass fibre length resulting during the compounding step. This model is dependent on the current residence times, the shear rates and the viscosities in the screw zones examined. The breaking of the fibre is determined by means of the critical compressive force and compared to the forces resulting from the flow process of non-newtonian materials. In this way a statement can be made about the average fibre lengths in the mixing zone. In order to verify this approach the model was implemented into the twin-screw simulation software SIGMA developed by the KTP. Because of the fact that Sigma calculates the process behaviour like the residence time, the shear rates and the viscosity this model can be connected with these already existing results to estimate the average fibre length. In first experiments compounds with a constant glass fibre amount are used. Therefore an experimental design was generated that varies the different process conditions like the pressure at the screw tip, the screw speed, the throughput, the barrel temperatures and the screw configuration in the mixing zone for two polypropylenes. The final fibre lengths modelled from the simulations are compared to the average glass fibre lengths from these experimentally produced compounds mentioned. In future the stress appearing in the flow can be derived from numerical simulations and can be compared to those results of SIGMA.