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Sequential Injection Moulding – the Influence on Weld Lines

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In the automotive industry, thermoplastics are used for large-scale parts, e. g. bumpers. Usually multiple gate filling is necessary, which leads to multiple melt streams and subsequently to so called weld lines. The presence of weld lines significantly reduces the strength of injection moulded parts. Different technologies are available to improve or even avoid weld lines. For example, sequential moulding is applied by using a hot runner system including valve gates with an integrated needle drives. By opening and closing the valve gates step by step a gradual filling and back pressure phase is achieved. The advantage of this technology is mainly the positive influence on weld lines, e. g. on their position and, if glass fibers are involved, also on fiber orientation.
In this paper an experimental and simulation study of the process induced fiber orientation in weld line areas is shown. For the experiments a special mould was designed for sequential moulding that includes up to five valve gates. The presentation shows the comparison of different sequential injection moulded parts on the basis of a platen (material: polypropylene with 30 % glass fibers) where the weld line occurs behind an obstacle. By proper controlling of the opening sequence of the valves the weld line position and additionally its special fiber orientation should change. Weld line location and fiber orientation are determined by measurements along the cross section. The measured fiber orientation was compared with a filling simulation.
In conclusion a good agreement between calculated fibre orientation and the measured results is found. Sequential moulding has shown to be a good tool to highly improve the weld line situation for glass fiber reinforced thermoplastics.