Investigation of specific FDM process parameters to optimize the polymer discharge of carbon fiber reinforced PEEK

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Keywords. Fused Deposition Modeling, PEEK, polymer extrusion, process parameter optimization, pressure control

Abstract.

Fused Deposition Modeling (FDM) is a widely used manufacturing process and the materials market is growing due to the increased requirements on materials. In particular, processing of high-temperature materials such as PEEK is challenging. The aim of these studies is to investigate and improve the processability of different carbon fiber reinforced polyether ether ketone (PEEK) materials in the FDM process. The first step is to define the relevant process parameters, which remain constant over the entire investigation. In particular, the material-specific temperatures must be specified. Based on previous investigations regarding the weld seam strength and the warpage of the selected PEEK materials, a method to determine and adjust essential process parameters should be developed. One approach is the consideration of the volumetric polymer discharge at a stationary filament feed rate. The optimized adjustment of the feed rate ensures increased component densities and an improved process reliability. In this context, the component areas with non-stationary extruder movement, such as in corner areas, have got a huge influence on the component quality. The acceleration and deceleration processes do not result in a desired uniform strand geometry due to the static pressure within the nozzle. The acceleration can result in thinner strands while the deceleration can lead to a thickening of the polymer discharge. The aim is to adjust the pressure inside the nozzle depending on the acceleration profile to enable a homogenous strand geometry. The method should therefore allow the improvement of the processability of PEEK materials regardless of specific component geometries.