Interlayer shear characterization of additively manufactured short carbon fiber-reinforced polymer

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Abstract.
The additive manufacturing (AM) techniques Fused Deposition Modeling (FDM™) or Fused Filament Fabrication (FFF) are all based on material extrusion and are one of the most widely used AM methods. Serial production with this technology requires a deep understanding of the process and the effects of the process parameters on the mechanical properties. In literature tensile, compression or flexural properties are often considered. However, the basic structure of FFF parts is strongly anisotropic and therefore similar to a composite material. The characterization of a carbon fiber-reinforced polymer (CFRP) involves additional material properties. One of the strongest quality values for CFRP is the interlaminar shear strength (ILSS) in the midplane direction. The ILSS can be handled in an equivalent way for AM parts in form of the interlayer shear strength. The literature shows various approaches, but no existing standard to determine the interlayer shear strength for FFF parts. The aim of the study is a suitable experimental setup for identifying interlayer shear strength of AM parts. An experimental setup and the specimen geometry in accordance to DIN 65148 are adapted to ensure an interlayer failure mode between two layers. The newly developed test approach is validated with a test series showing a decrease in ILSS of up to 40% by increasing the layer height.