Material Modeling of Selective Laser Sintered Polyamide 12

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Motivation

Pipes and hoses in automotive and aircraft construction represent the central area of application for polyamide 12 (PA12). This is due to its exceptionally high abrasion resistance, high fatigue resistance, and good chemical resistance [1]. The design freedom of the selective laser-sintering (SLS) process allows uncomplicated production of tube specimens suitable for a torsion test generating a deviatoric stress state.

Objectives

- Development of a material model for describing the mechanical behaviour of the tube specimen based on rheological models ensuring compatibility with the second law of thermodynamics.
- Describing the operational stability based on the rules of fatigue strength

Experimental data & process of the investigation

Selective laser-sintered specimens under torsional load show the phenomena of viscoelasticity and viscoplasticity typical for semi-crystalline polymers [2] [3]. The results of the laser sintering process are anisotropic. Fig. 1 shows the results of orthogonally arranged specimens.

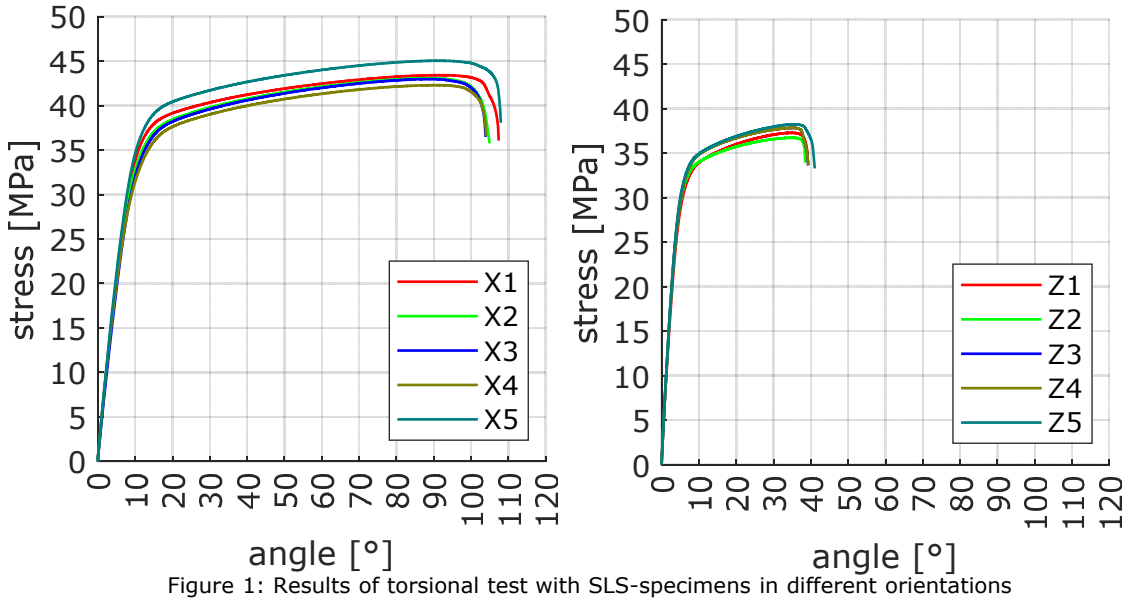

Figure 1: Results of torsional test with SLS-specimens in different orientations

The different effects of basic elasticity, viscoelasticity, and viscoplasticity have to be identified during experimental investigations and modeled subsequently to build a model for FE implementation always considering practical applicability.

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References

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