MANUFACTURING TECHNOLOGY – ADDITIVE MANUFACTURING FOR THE PRODUCTION OF POLYMERIC COMPONENTS

For the successful application of additive manufacturing processes in technically demanding plastic applications in drive technology, the optimal selection of processes and material as well as practical and accurate design and construction guidelines is necessary. The specific and closely linked dependencies of production processes, materials and component design represent a challenge. This basic-oriented preliminary project compiled a targeted literature research with regard to relevant application potentials. The work is carried out jointly by the Direct Manufacturing Research Center (DMRC) and the Institute for Composite Materials (IVW).

PROJECT OVERVIEW

DURATION

02/2018 - 04/2018

PARTNER

Institut für Verbundwerkstoffe GmbH
Kaiserslautern (IVW)

FUNDED BY

FVA e.V. (Forschungsvereinigung Antriebstechnik – Research Association for Drive Technology)

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Motivation and aim

The aim of this project is to introduce the FVA members to the use of additive manufacturing methods for plastic components in drive technology and thus to open up the potential of additive manufacturing for innovative components with lower costs, higher power densities and shorter development times (time to market). Furthermore additive manufacturing can help to make their production environmentally sustainable and with a high degree of digitalisation.

Proceeding

The project is divided into two main work packages – a literature research and an experimental investigation.

1. Literature research

The systematic literature research is adapted to the substantial aspects of the application of additive manufactured polymer parts in drive technology and focuses on

- an overview of the available AM technologies and processes,
- an explanation of the new design possibilities (bionic design, time to market,…),
- the potential for innovation for components or assemblies,
- material properties,
- process, design and material-limited performance limits of AM processes,
- cost-effectiveness analysis and
- determination of available, relevant design guidelines and tolerances as well as standards.

2. Experimental investigation

Within the framework of the experimental investigation, the specific application potential of additive manufacturing processes and materials available on the market for drive components is determined. For this purpose, tribological and mechanical experiments with various materials are performed and thereby the following properties are examined.

- Specific wear rate
- Coefficient of friction
- Tensile strength
- Young´s Modulus
- Elongation at break

Block on ring tests (ASTM G 137) (Figure 1) were carried out to determine the wear rate and the coefficient of friction as well as tensile tests to determine the mechanical parameters. Figure 2 shows a worn surface of PA12 specimen. The test specimens are produced by different technologies with various materials and a subsequent comparison with characteristic values of conventionally injection-molded samples was performed after the experiments (Figure 3). Literature data of the corresponding materials complete the estimation of the potential.

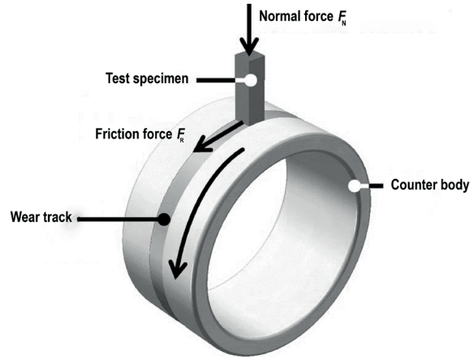

FIGURE 1 Block on Ring test according to ASTM G 137 [ASTM G 137]

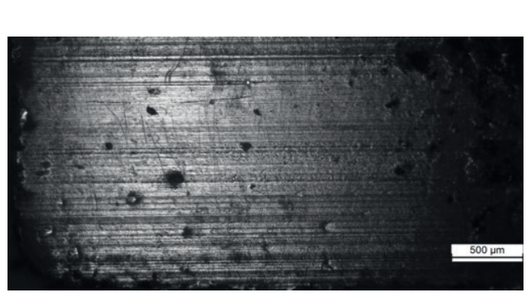

FIGURE 2 Worn surface of a laser sintered PA12 specimen

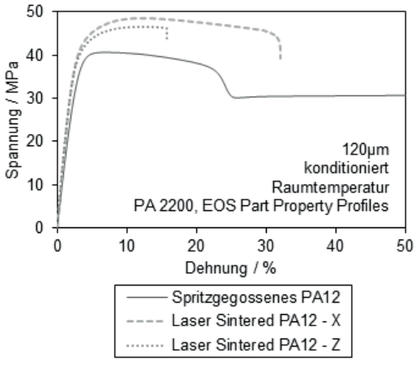

FIGURE 3 Comparison of laser sintered and injection molded PA12 mechanics