Polymer Gears

Motivation

In terms of economic manufacturing, dry run capability and specific material modification, polymer gears are advantageous over metal gears. As a consequence, the importance of polymer gears for tribological applications in various industrial sectors steadily increases.

One challenge is that polymer parts exhibit higher wear rates under tribological stress.

Therefore, research about the interactions between material and counterpart properties, stress collective and environmental influences as well as the resulting system behavior is needed to enable the tribological improvement of polymer gears (Fig. 1).

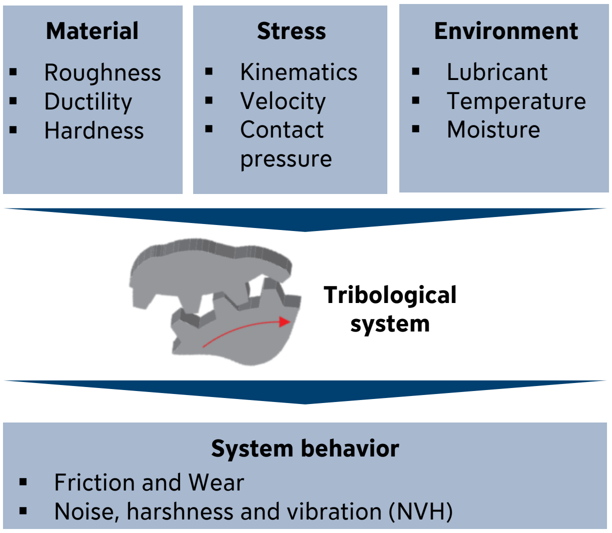

Fig. 1: Analysis of a tribologic gear system

Application

Polymer gears can be found in many kinds of power transmission systems. They are widely used in various industrial sectors like automotive, household devices or electronics. Examples for practical applications are actuating drives in cars, medical devices like drug dosage systems or drives for home appliances (Fig. 2). The production by injection molding enables the manufacturing of very small parts. Therefore, polymer gears are increasingly used in microdrive systems.

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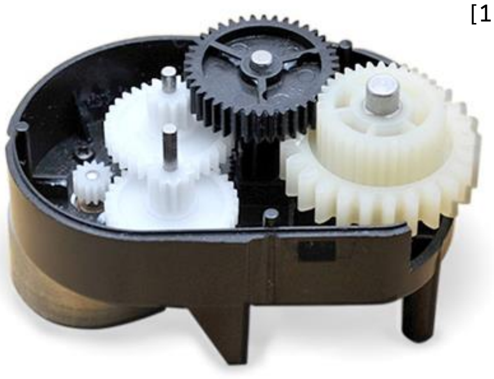

Fig. 2: Plastic gears of different size in a trash can motor

[1]: zwgearbox.com

| Institute of Polymer Technology
| Am Weichselgarten 10 | 91058 Erlangen-Tennenlohe, Germany
| Phone: +49 9131 85 710 00 | Fax: +49 9131 85 710 07
| Mail: lkt-info@fau.de | https://www.lkt.tf.fau.eu/

Research focus

One of the main research fields at the Institute of Polymer Technology (LKT) is the process oriented tolerance management of polymer gears. The aim is to define acceptable dimensional deviations of plolymer gears using knowledge about the manufacturing process. Since the manufacturing process highly impacts the gears´ morphology (Fig. 3) and dimensional accuracy, the interactions between the injection molding process, the resulting part properties and the wear behavior of polymer gears are analyzed in detail.

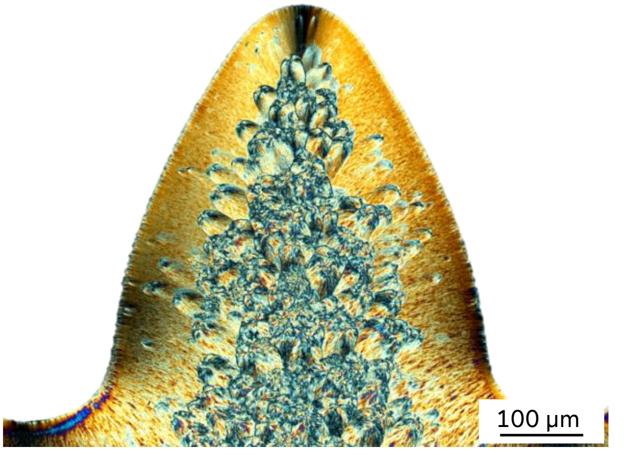

Fig. 3: Morphology of polymer gears due to the manufacturing process

Main research results

To examine the wear of polymer gears in detail, an in situ gear test rig was designed at the LKT. The test rig (Fig. 4) realizes the continuous in situ wear measurement of polymer gears. This allows deeper research of the wear behavior especially differentiating between the run-in phase, which is characterized by higher instationary wear rates, and the stationary wear phase. Therefore, the influence of targeted induced dimensional and morphological deviations on the alignment of the contact surfaces taking place in the run-in-phase, can be investigated in detail. Further, the new in situ test rig allows the separation of the different mechanisms (wear, elastic and plastic deformation), which enables an optimized gear design.

Fig. 4: In situ gear test rig developed at the LKT

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| Mail: lkt-info@fau.de | https://www.lkt.tf.fau.eu/