

The Potential of Bio-Based Polymers for the use in Gear Transmissions

Damijan Zorko, MsC, Laboratory for Engineering Design, Faculty of Mechanical Engineering, University of Ljubljana, Slovenia

Borut Černe, MsC, Laboratory for Engineering Design, Faculty of Mechanical Engineering, University of Ljubljana, Slovenia

The use of polymer gears is rapidly increasing due to their advantages when compared to metal gears. The most important ones are lower weight, better dampening of vibrations (and consequently lower noise during operation), possibility of operation without lubrication, and cheap mass production with the use of injection molding. Due to inferior mechanical properties of polymer as compared to metals, this type of gears can only be used for power transmissions where lower loads are being transmitted. Also, the operation temperature is limited since mechanical properties of polymers deteriorate with temperature increase. The main failure types of polymer gears are thermal failure, wear and fatigue. To achieve reasonable lifetimes, polymer materials need to retain good mechanical properties at elevated temperatures. The problem with the use of polymer materials is their environmental impact after disposal. There is a great

potential in the use of bio-based polymers, which are bio-degradable and can in some cases even be recycled. Presented research was focused on the performance and durability of gears made out of biopolymers. In the presented work we tested gears made out of PA 6.10, which is a biopolymer obtained from the oil of castor seed, and a wood plastic composite, where the matrix, made out of PP, was filled with wooden fibers in the ratio 30% of PP and 70% of wooden fibers. Lifespan testing results were compared with the performance of two commercial grades of POM and PA, which are the most commonly used materials for polymer gear applications. The performance of biopolymer gears proved to be comparable and a potential for practical use was observed. The obtained results provide needed data for reliable design of gears made out of biopolymer materials

damijan.zorko@lecad.fs.uni-lj.si