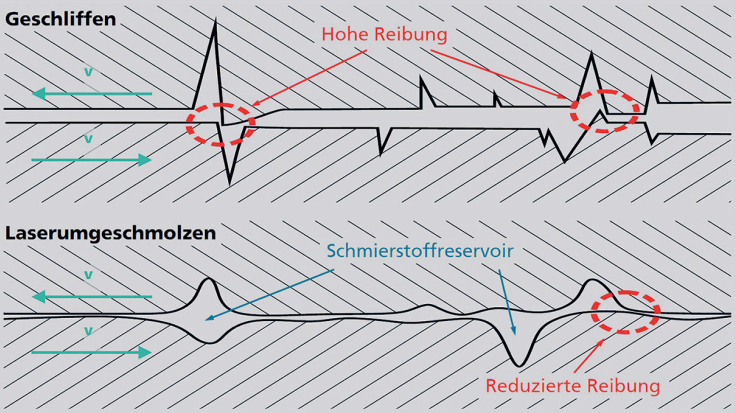

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Subject to alterations in specifications and other technical information. 06/2020.

LASER MELTING FOR REDUCING FRICTION IN TRIBOLOGICALLY STRESSED COMPONENTS BY ADJUSTING THE SURFACE TOPOGRAPHY

Task

In drive technology, especially in transport, more than one third of primary energy consumption is caused by the conversion of mechanical energy into movement. To a large extent, the efficiency in drive technology is influenced by friction losses in components subject to tribological loads, such as rolling bearings, gear teeth or valve drives. Using low-viscosity oils combined with a specifically adjusted roughness or surface topography is a suitable measure to reduce friction. To set defined surface topographies for components with complex geometries, however, the industry requires additional, time-consuming and cost-intensive manufacturing processes.

Method

Laser melting (λ = 1064 nm) is an alternative manufacturing process to face such challenges. In contrast to laser structuring, laser melting does not remove material, but redistributes it in the molten phase using the material's own surface tension. In this process, only the roughness peaks are rounded off by local melting so that the grinding grooves, which serve as lubricant reservoirs, are preserved. This is intended to achieve an improved lubricant film build-up and, at the same time, reduce friction since the roughness peaks are rounded off. For this purpose, ground discs (material: 100Cr6) are remelted with pulsed laser radiation (pulse duration t = 400 ns) and then measured on a ball/disc tribometer. During this process, the ball is up to half in the oil bath so that lubricant is transported by rotation into the tribological contact between ball and disc. The coefficients of friction are compared with those of ground surfaces, which depict the state of the art for gears.

Results

Laser melting can be used to reduce the coefficient of friction by 40 percent in the mixed friction area, as compared to ground surfaces. The coefficient of friction is, thus, in the range of conventionally polished surfaces.

Applications

The targeted use of laser melting as a manufacturing process for tribologically loaded components is conceivable especially in automotive engineering, but also in the field of wind energy, for example. The tribometer tests were carried out at the Institute for Machine Elements and Systems Engineering MSE at RWTH Aachen University.

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1 Schematic representation of the surface contact of two surfaces moving relative to each other.