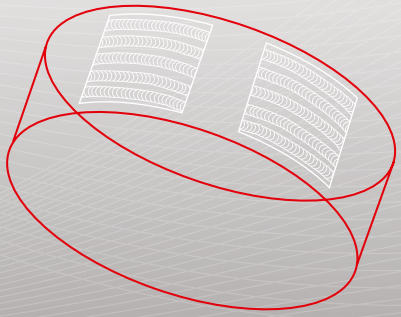
Laser structuring



Laser structuring for roughening surfaces is being increasingly used. This produces raised micro profiles, which achieve the highest possible static friction to the counter body. The pulsed laser beam is focused on one point the material surface, resulting is very high local intensities. The material is converted into the melt phase by the thermal processing.

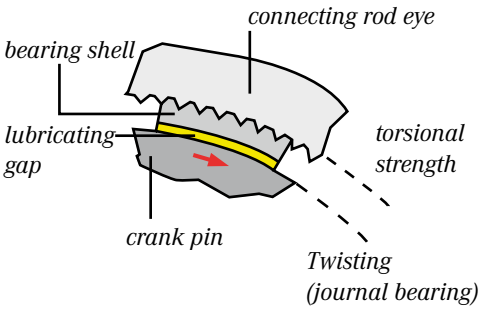
This leads to melt beads, which protrude as elevations from the surface. These individual profile peaks consist of melt burrs, which are formed as raised structures in the surface of the counter-body and produce high static friction.

Goal of laser structuring

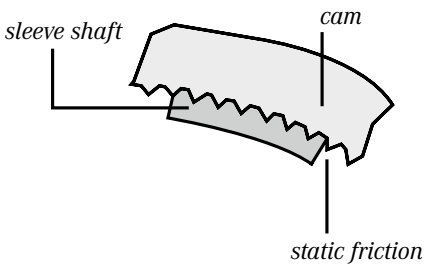
The roughening of technical surfaces with static friction function creates a lossless torsion-proof and/or anti-slide connection between two components. This combination fulfills the functional requirements, simplifies the engineering design of the components and substitutes friction enhancing intermediates such as diamond foils or galvanic diamond coating and thereby reduces the production costs of one unit.

Principle of laser structuring

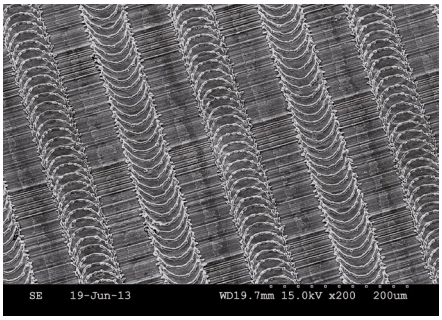
The raised profile structures cause a micro-positive contact between the contact surfaces, which results in traction thru static friction. A structural transformation and hardness increase during the machining process are the result of steep temperature gradients from the energy input of the laser beam. The raised melt protrusions of ferritic materials are composed of martensitic microstructures. Because of their increased hardness, they work invasively on the surface of the counter body. They press into the softer exterior of the unstructured material, i.e. the bearing shell, thereby enabling a reliable energy transfer.



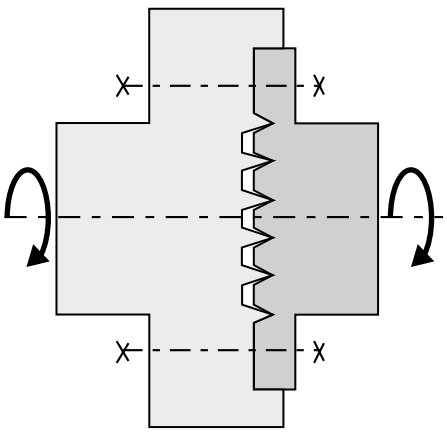
Function of the lasered connecting rod



Function of the assembled cam shaft



Laser structuring to increase the static friction



Front face connection

Devices for laser structuring

To industrialize laser structuring, devices were developed that work in modern production lines with high process reliability. Depending on the application, different beam sources with scanner optics are used.
To reduce the cycle time, multiple beam sources can be arranged.
The arrangement depends on the machining job. During the structuring of bored segments, the beam passes into the bore at a diagonal. Directly accessible surfaces can be processed with a vertical laser beam.

Application examples

Connecting rod with structured big eye

Chain wheel (front face connection)

Cam of an assembled cam shaft

Gehring laser structuring machine

Advantages

- Substitution of diamond foils or diamond coating (front face connection)
- Substitution of slot and feather key (connection hub – shaft)
- Freely selectable surface structure
- No tooling costs
- Short machining time of a few seconds (depending on job and layout of the machine)
- No tensioning of parts
- Practically no heating of the part
- High reliability
- High degree of automation
- Worldwide experience in series production

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