

New Scientific Results, Theses

1. On the basis of the experiments performed (dry sliding friction investigations during continuous unidirectional and alternating movements between steel surfaces of sphere-on-sphere and sphere-on-plate form), the conclusion was drawn that the process of particle detachment and re-build of detached particles into the wear track, as well as third-body formation are not simple, consecutive elementary partial processes but rather simultaneous phenomena occurring parallel to each other, and they jointly execute determining role in the formation of wear mechanism from the very beginning of the friction while significantly effecting each other, as well.
2. Start of particle detachment can be modelled with the application of finite element technique using the deformation capacity depending on the actual stress and deformation as elaborated by Darvas and Ziaja.
3. The experimental observation is being confirmed by our finite element simulation on a model with rough friction surfaces that a kind of uneven deformation state might be formed out in the near surface layer owing to the surface roughness; this uneven deformation state seems to be enough to cause starting of particle detachment simultaneously with the start of friction.
4. In accordance with the 3D profilometer measurements and the microscopic examinations of wear tracks, re-build (re-entry) of the particles into the wear track, as well as third body formations have a determining significance in the formation of the wear track. This observation is also confirmed by finite element modelling of particle detachment. During the numerical simulation, wear track formed out owing to particle detachment is significantly deeper than the one being experimentally determined.
5. As confirmed by the numerical simulation, the exhaust of the deformation capacity prior to particle detachment does not occur during direct contacting (i.e. in the contacting zone) but rather basically behind the contacting section, in the zone of tension stress state. The actual contact zone is somehow “protected” by the hydrostatic component of the stress state thereby providing the necessary deformation capacity to the near surface layer.