Two scale modelling of wear and oxidation processes
J. Maciejewski1,2, M. Bialas 1, and Z. Mróz1
1 Institute of Fundamental Technological Research, Polish Academy of Sciences
2 Institute of Construction Machinery Engineering, Warsaw University of Technology

Materials and their applications

FUNCTIONAL NANOCOMPOSITE COATINGS
Nanocomposite TiC/a-C:1(H) coatings
MoS2-Ti coatings
Oxide coatings – V2O5,
Functionaly graded materials (FGM)
Cu-Al2O3- systems, Al2O3-NAl

Macroscopic scale
Thermo-mechanical analysis of coupled wear – oxidation and temperature field at transient and steady state

Wear-oxidation model – two-scale aproximation

Model of oxidation kinetics FGM (thruster, brake disk)

Input data
Initial surface topography
material parameters (thermal, elastic)
µF
fraction of frictional contact

Asperity scale
Stress distribution
Heat flux affected by friction

Temperature distribution within representative element

Conclusion
- oxidation starts from Tmin
- macromodelling does not allow for oxidation (obtained temperatures are smaller than Tmin)
- micromodelling results in flash temperatures bigger than T min – can be described
- assumption that friction coefficient is a function of temperature µ(T) in asperity scale provides macroscale µ(T, σn)