Karlsruher Institut für Technologie

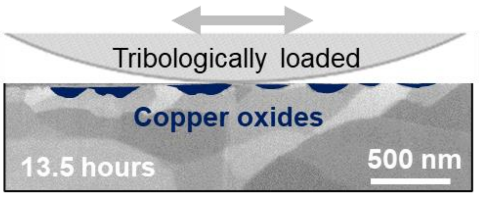
Institut für Angewandte Materialien

Bachelor-/Master Thesis

Analysis of the Tribo-oxidation Mechanisms by Mechanism-based Crystal Plasticity Simulation

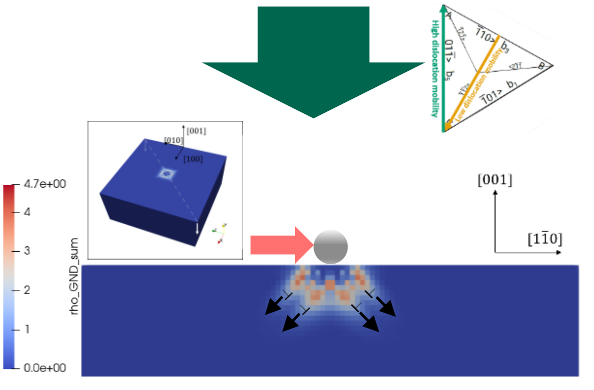
Background:

The surface oxidation of materials generated due to the tribology loading has a great influence over wear, friction and the lifetime. One of the hypotheses to the formation of an oxide layer on copper is the tribologically induced defects (such as dislocations) serving as diffusion paths and accelerating oxidation formation.



Rau et al.,(2021)

To investigate this mechanism, it is of interest to further analyze the dislocation structure induced by tribology loading under different conditions, such as dislocation mobility, grain orientation, and initial dislocation density. The application of a meso-scale mechanism based simulation method considering homogenized dislocation network formation, dislocation movement, and interaction can allow for the investigation of the dislocation structure and further analyze the elementary mechanisms of the oxidation formation observed within experiments.



Goals of the thesis:

The goal of this bachelor/master thesis is to investigate the dislocation evolution induced by tribology loading, which can be considered as one of an elementary mechanisms of tribo-oxidation in copper. Therefore, by conducting the finite element simulation based on the continuous dislocation dynamic (CDD) theory, the dislocation structure induced by tribology loading under different dislocation mobility will be predicted. The outcome will be further analyzed in comparison with the experimental results.

Requirements :

Within this study, it is required to investigate the dislocation structure under different parameters according to the experiments using a non-commercial finite element program, written in C++, therefore,

- Basic knowledge and interest in material science, finite element simulation are needed.
- Programming knowledge of C++, python are advantages but not mandatory.

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