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Dislocation interactions in subsurface copper inducing electric breakdowns

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Mechanisms behind breakdowns on copper surfaces have been studied with various methods using both experiments and simulations. The high-voltage direct current measurements with the Large Electrode System in CERN have been proven good in acquiring statistics on a large number of breakdown events. Recently, similar experiments have started at the University of Helsinki in order to provide information about copper electrodes treated in various ways.

Based on the fact that the breakdown hardness is correlated with the crystal structure of the material, dislocations have been suggested to have impact on stresses in the near-surface region and eventually on the breakdowns. Grain boundaries and other crystal defects are expected to act as dislocation concentrators.

Discrete Dislocation Dynamics (DDD) method has been used to simulate the movement of dislocation segments in near-surface copper and to see how they interact with different obstacles and each other. As the simulation conditions have been adjusted to match the experiments and the DDD allows the scales of simulations to be in the same order of magnitude, they are both able to complement each other.

The poster presents the preliminary results from these simulations and the first observations from the experiments in Helsinki.

Type of contribution

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Modelling and Simulations

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