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# Simulation and measurement of charge transport in the periphery of planar silicon sensors to understand humidity-induced breakdown

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The top oxide/nitride passivation layer of silicon sensors is known to be sensitive to ambient humidity and the sheet resistance of the interface with the air decreases in humid environments. Planar silicon sensors are usually operated at high bias voltages which, if operated in a humid environment, can lead to charging up of the passivation surface which in turn can lead to undesirable effects such as early electrical breakdown.

To explore the exact mechanisms behind this phenomenon, Synopsys TCAD was used to simulate the electrical behavior of the surface of a test structure for different relative humidity. The influence of humidity is characterized by the humidity-dependent mobility of impurity ions on the outer passivation surface. To verify the results of the TCAD simulation, Transient Current Technique (laser) measurements and accompanying Allpix Squared simulations have been performed in the edge region of the test structure, where humidity-related breakdown was observed.

For these simulations in the edge region, charge transport at the Si-$SiO_2$ interface had to be implemented in Allpix Squared. This implementation models the dynamics as charges propagate within the inversion layer. Comparing the simulations to the TCT measurements helps to validate the TCAD simulation and to gain a better understanding of surface TCT measurements in the edge region of sensors, enabling further exploration of the humidity dependence of surface breakdown.

## Will the talk be given in person or remotely?

In person

**Authors:** Dr BRÜERS, Ben (Deutsches Elektronen-Synchrotron (DE)); Dr SCHARF, Christian (Humboldt Universität zu Berlin); Prof. LACKER, Heiko (Humboldt Universität zu Berlin); Ms NINCA, Ilona (Deutsches Elektronen-Synchrotron (DE)); Dr BLOCH, Ingo (Deutsches Elektronen-Synchrotron (DE)); Ms LI, Peilin (Humboldt Universität zu Berlin)

**Presenter:** Ms LI, Peilin (Humboldt Universität zu Berlin)

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