



SwissSEM

Investigation of cosmic ray reliability of nanoscale oxide layers in power semiconductors by Proton and Neutron irradiation

SwissSEM Technologies AG is a recently founded Start-Up company specialized on research, development and design of power semiconductor devices and modules. Currently, the focus is on the development of power devices targeted for applications like the traction chain of electric vehicles and converters for renewable energy sources like solar and wind power.

For an efficient and sustainable supply and usage of energy, many applications are being electrified and use the energy provided from renewable sources. The key elements required for the conversion of electrical energy in these applications are power semiconductors. The functionality of modern power semiconductors critically depends on the reliability and integrity of their gate oxide layer which typically has a thickness of 50-100 nm. These nanostructures

must withstand high electrical fields and harsh environmental conditions for many years including high temperatures, humidity,

corrosive gases, and last but not least the impacts of cosmic rays.



In this project, the effects of cosmic ray irradiation on the reliability of nano-scale gate-oxide layers are assessed under realistic electrical conditions. In a specifically developed test setup, power semiconductors provided by SwissSEM are exposed to proton and neutron irradiation while a gate voltage is being applied. The aim is to understand device failures related to cosmic ray irradiation into their gate oxide layers. The results of the project will support the

development of more robust power semiconductors.

The analytical services of ANAXAM are part of the Nano Argovia project CRONOS financed by the Swiss Nanoscience Institute, an interdisciplinary collaboration with the FHNW - Institute of Electric Power Systems and the company SwissSEM Technologies AG.

For this customer project, ANAXAM used PIF beamline at the Paul Scherrer Institute and the ChipIR Beamline at ISIS Neutron and Muon Source at Rutherford Appleton Laboratory.

“ This project will help us to understand different failure mechanism due to cosmic ray radiation and in this way enable us to develop future, more rugged devices. A very important aspect is that we through this project also have been able to establish a base of connections to the right people, which will in the future enable us to enter complex research topics like this.”

Dr. Arnost Kopta, CTO,
– *SwissSEM Technologies AG*

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