Contribution ID: **28** Type: **not specified**

Talk 1: Current capabilities and future requirements in radiation testing in Europe

Wednesday 12 June 2024 14:05 (20 minutes)

Abstract:

It is long established that terrestrial cosmic radiation (TCR) can lead to the destruction of semiconductor power devices - such as diodes, MOSFETs or IGBTs –for a large range of voltage classes (˜ 300 –7000 V) [1]. The general mechanism are neutron-nucleus collisions that create highly energetic spallation fragments within the device, and which can deposit sufficient energy to lead to irreversible device failure. Depending on application parameters, TCR-induced failures can become a significant factor regarding device reliability and must be determined consistently before field application by the manufacturer.
Reliability requirements for single chips are usually in the range of 0.01 - 100 FIT (Failures in time), with 1 FIT being 1 fail in 109 device hours. To quantify such low failure rates accelerated tests are necessary, in which case artificial neutron sources are used which have fluxes that are several orders of magnitude above the natural TCR [2]. Currently, the only instrument in Europe with atmospheric-like neutrons that fulfills the requirements for industry standardized testing is the ChipIR instrument at the ISIS spallation source, UK.
However, the ever-growing market for power semiconductor devices - driven e.g., by the rising adoption of renewable energy sources, IoT devices and automotive electronics –will significantly increase the demand for testing capacities in upcoming years. Considering that the market is highly competitive with fierce competition from American and Asian companies, who coincidentally also have more testing sources available, emphasizes the need for a second source for atmospheric-like neutrons in Europe.
In this contribution current capabilities and future requirements in radiation testing are presented from the perspectives of semiconductor manufacturers. In particular, our need for new artificial sources in Europe and their envisioned characteristics will be discussed.

CV:

I obtained my PhD in Physics in 2013 from the Saarland University, Germany. Afterwards I worked several years as a postdoctoral researcher and research assistant in Santander, Spain and Luxembourg before joining the Heinz Maier-Leibnitz Zentrum in Munich, Germany as instrument scientist at the neutron spin-echo spectrometer RESEDA. My scientific work focused on small-angle neutron scattering techniques before joining Infineon in January 2022 where I work in the cosmic ray robustness testing unit of the R&D department of the green industrial power (GIP) division.

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Session Classification: Session 2: Atmospheric Industrial Session