

Talk 2: Temperature dependence of Cosmic Ray failure mechanism in the SiC Power MOSFET (UK - SWIMMR Program)

Wednesday, 12 June 2024 14:25 (20 minutes)

Abstract:

This study was performed inside the UK-Space Weather Innovation Measurement Modelling Risk (SWIMMR) dedicated to space weather and its effect on terrestrial electronic devices. It was performed in cooperation with ISIS-CHIPIR and the Physics and Chemistry Department of Palermo University and STMicroelectronics. The cosmic ray impacts in the atmosphere make new particles clusters and under 20km of altitude the main particles present are neutrons, and they can produce effect in electronic devices. For Power devices, they induce a Burn-out and the devices are over.

Today the extensive use of new Power Devices with Wide Band Gap material in automotive applications requires accelerated neutron testing to identify the failure mechanism. This study is addressing the temperature effects in the neutron interaction of SiC Power Mosfet, which is mandatory to estimate the failure in time for the mission profile.

The new WBG material is being deployed in new application solutions in avionics. New services are under development, for example City Air Mobility which will use the new electric vehicle drone for the civil mobility. This increase of power devices in more and more electrical vehicles will require an intensive neutron test characterization. Moreover, the new space era with the presence of private industries in space missions and new low orbit constellation satellite will require more and more heavy ions characterization of standard automotive component for space use.

This scenario leads to the need to increase the number of both the neutron and heavy-ions facilities present in Europe. For the neutron facility, we plan an investigation of the effects on electronic component of the higher neutron energy (> 800MeV), because this energy could be present in avionics altitude.

In the presentation, we will be share the testing methodologies used, the results obtained and a requirement for new facilities based on the above scenario.

CV:

Rad-Hard Design Manager and Radiation expert for Power Transistors

He received his degree in Electronic Engineering at Palermo University in 2001. Since 2002 he has been working in STMicroelectronics as a power discrete transistor designer. The current position is rad-hard design manager for power transistor inside the Power & Discrete R&D Group. In his job, he acquired experience in radiation effect (Co60, X-ray, heavy ions) for space application, cosmic ray effect for avionics and automotive power application, and advanced reliability. Since 2016 he leads research projects (Characterization of Gate oxide of Silicon and SiC Power Mosfet by X-ray source – Characterization of Silicon and SiC Power Device by atmospheric neutron and alpha particle) with Physics and Chemistry department of Palermo University. From 2020, he leads a research project with a European avionics company to implement the SiC power Mosfet in new electrical vehicles. He has research cooperation with IRT- Saint Exupery as part of the SECRET project and is a member of the scientific panel of the ISIS-CHIPIR facility. He is the author or co-author of more than 20 technical and conference papers.

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