Institute for
Drive Systems and
Power Electronics
https://www.ial.uni-hannover.de/en/
Leibniz University Hannover

SE²A

Master Thesis:
Evaluation of the radiation hardness of GaN devices on a theoretical and physical level

Project Description

The goal of "Flightpath 2050" is to significantly reduce the CO_2 emissions of air traffic. This can be reached by electrifying not only the auxiliary systems, but also the main propulsion of the aircraft. To reduce energy storage weight and volume, a high efficiency distribution grid is necessary. Novel wide-bandgap semiconductors based on gallium nitride (GaN) promise lower losses, but are not yet examined for their principal suitability and qualification for use in the harsh aircraft environment. Especially sudden failures due to cosmic radiation pose a large and not yet evaluated danger. Therefore, this research project will contain a methodical evaluation of the radiation hardness of GaN devices.

Next to evaluation by tests under increased radiation, also a fundamental physical understanding of the radiation hardness of GaN devices shall be developed. Special focus is on the susceptibility to high energy neutrons. For this, the following working steps are necessary:

1. Evaluating the radiation spectrum at typical aircraft altitudes and comparison to the reference spectrum.
2. Literature research on failure mechanisms of GaN devices under radiation.
3. Gathering of principal physical laws for describing the neutron interaction with GaN devices
4. Estimation of the radiation hardness of GaN devices based on simplified models from nuclear physics. Keywords are: Cross Section, neutron interaction, Linear Energy Transfer, Bragg Curve

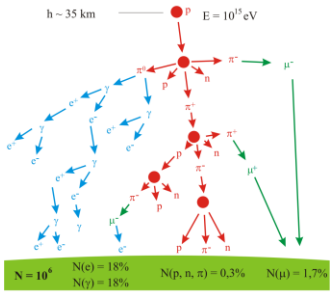

Fig. 1: Radiation Air Shower

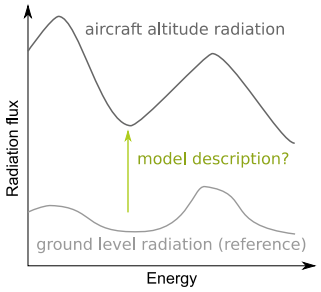

Fig. 2: Exemplary neutron spectrum at aviation altitude

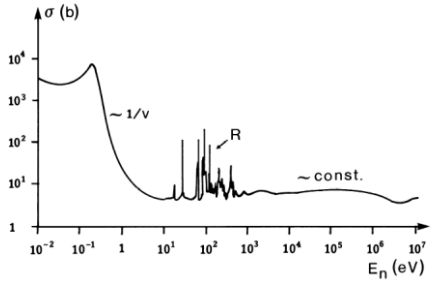

Fig. 3: Exemplary cross section for neutron interaction

Requirements

- Strong knowledge in electrical engineering and power electronics devices
- Basic knowledge in power semiconductor physics and wide bandgap devices
- Structured working approach
- Ability for abstract thinking

Contact information

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