TECHNISCHE UNIVERSITÄT WIEN
Vienna University of Technology

Institute for Solid State Electronics

New PhD position at TU Vienna

Experimental and simulation analysis of electrostatic discharge protection devices in advanced high-speed technologies

Introduction: During the manufacturing or operation of an integrated circuit (IC), the electronic devices are exposed to different kind of disturbing electrical pulses including electrostatic discharges (ESD). In high-speed applications, e.g. USB 3, the protection devices need to exhibit a low capacitance which contradicts the requirement for high ESD robustness [1]. These devices operate in breakdown regime and at extreme high current densities where the current-voltage characteristics is bistable which leads to variety of complex phenomena as current filamentation or inter-device coupling [2,3].

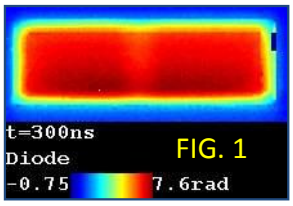

FIG. 1

Topic: The subject of this PhD thesis is the experimental and simulation analysis of the advanced high-speed Si discrete technology ESD protection devices. The PhD candidate will combine electrical and optical techniques to analyze breakdown phenomena, self-heating effects and the current density distribution in the ESD protection devices during the ESD pulses. The unique transient interferometric mapping technique will be employed to measure thermal and free-carrier response with ns time and µm space resolution (Fig.1). The obtained experimental data will be correlated to the results of TCAD simulation (Fig.2). The goal is to understand the device physics, in particular how the current distribution inside the device determines the electrical response (e.g. voltage overshoot) and ESD robustness.

[1] G. Notermans et al, IEEE T-DMR 19(2019)583; [2] C. Fleury et al. Microel. Reliab 76-77 (2017) 689; [3] H. Karaca et al. Proc. EOS/ESD Symposium 2019, Riverside, USA.

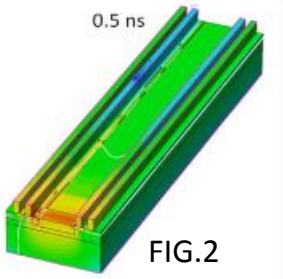

FIG.2

Hard facts: The topic is suited **both for electrical engineers and physicists** with the interest in semiconductor device physics and characterization, modeling and modern electronics. The work will be performed in the frame of a project contract with NEXPERIA Hamburg. It will contribute to the development of new ESD protection concepts and simulation methodologies. The work will be published in scientific journals and conferences. There is a prospect of permanent employment at Nexperia Hamburg.

Requirements: Basic knowledge of semiconductor device physics, English, completed master study
Duration: 3 years
Start: autumn 2020
Remuneration: approx. 2071 Euro Brutto/Month
Contact person: Associate Professor Dr. Dionyz Pogany (https://fke.tuwien.ac.at)
The application and CV should be sent by email to: dionyz.pogany@tuwien.ac.at