



Ampère

Unité Mixte de Recherche du CNRS - UMR 5005

Génie Électrique, Automatique et Bio-Ingénierie

PhD Thesis advertisement (Laboratoire Ampère - Lyon)

Thesis topics: Electrical Stress (Surge Current and Switching) to age GaN power devices

Scientific Context:

In the framework of the ICPEI/Nano 2025 GaN4reliability project, Ampere laboratory will recruit a postdoctoral position to achieve advanced characterization of GaN power devices. Wide-bandgap power components, such as gallium nitride (GaN), are particularly promising for the design of innovative power converters, with high efficiency and small footprint, for example for automotive applications. GaN offers a higher switching speed than SiC, making it potentially highly suitable for applications such as on-board charging, or DC/DC converter capable of operating at higher switching frequencies. However, GaN power components such as GaN HEMTs, have some reliability problems, with drifts observed in on-state resistance (dynamic), current collapse, threshold voltage and even leakage currents.

Goals / Purpose:

Coupling aging studies with physical characterization (physically characterizing components as they age) will enable us to trace the role of the material.

Electrical characterization of components will be based on different methods like: I(V) in static, Repetitive Switching measurement, Surge Current, Avalanche mode and short-circuit mode.

The main target corresponds to lateral diodes on GaN (with a 2DEG channel) but some test could be applied to HEMT devices depending on the availability.

The targets are:

- Definition of the electrical aging from the different electrical characterization
- Identification of the evolution of the electrical characteristics with the electrical aging

Structural and Active traps on GaN Devices will be characterized before and after the electrical aging

Research planning and Scientific approach:

At the beginning of the thesis, bibliography researches on GaN existing devices (properties, defects and limitation...) will be performed and pursued during the entire thesis. After an initial formation of the different characterization technics (I(V) in static, Repetitive Switching measurement, Surge Current, Avalanche mode and short-circuit mode), GaN devices coming from ST Microelectronics will be electrically characterized and aged. Some TCAD simulations will be done to modelized the evolution of the electrical characteristics on the GaN devices.



Candidates' Background:

Last year of Engineering school or Master 2 in Electronic, Semi-conductor Material, Micro-Nano Technology
Interesting, Stringent and Self-Contained.
Ability to summarize

Required Knowledge:

Physics of Semi-conductor, Device-physics, Electronic, Power Electronic

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Thesis location: Laboratoire Ampère, INSA de Lyon, Villeurbanne, France

Start Date: February 1st 2024, Oral hearing December 2024.

Provided documents by the candidate:

- CV
- Motivation Letter
- Academic Transcript

Send your candidature to: pierre.brosselard@insa-lyon.fr