

Sujet thèse / PhD subject 2025

Titre Thèse	Développement de Nouveaux Dispositifs de Puissance Basés sur l'Aluminium Nitrure (AlN) Vertical Pur	
PhD Title	Development of Novel Power Devices Based on Pure Vertical Aluminum Nitride (AlN)	
(Co)-Directeur	Farid Medjdoub	E-mail : farid.medjdoub@iemn.fr
(Co)-Directeur		E-mail :
(Co)-Encadrant (s)		E-mail :
Laboratoire	IEMN	Web :
Groupe(s)	WIND	Web : https://www.iemn.fr/en/la-recherche/les-groupes/groupe-wind
Projet phare principal	Composants	
Demande de fléchage IEMN ? (Energie / Nanocaractérisation / Technologies Neuromorphiques)	Non : Flagship choisi :	
Demande de labellisation Université de Lille (GREAL, labellisée)	Non : Label :	
Financement demandé	Contrat Doctoral Etablissement	ULille <input checked="" type="checkbox"/> Centrale Lille <input type="checkbox"/> JUNIA <input type="checkbox"/>
	Région ou Autre <input type="checkbox"/> Préciser :	Co financement acquis : Demi-financement fond propre, groupe WIND

Résumé / Abstract :

The project aims to pioneer the next generation of power electronic devices by exploiting the exceptional material properties of AlN, including its wide bandgap, high thermal conductivity, and high breakdown field. These properties make AlN an ideal candidate for high-power, high-temperature, and high-frequency applications. The research will focus on the design, fabrication, and characterization of pure vertical AlN-based power devices, which offer significant advantages over traditional lateral devices in terms of power density and performance.

A key aspect of this project is the use of unique doped AlN growth material, which will be provided by NC State. This material will be specifically engineered to enable the fabrication of high-performance vertical devices, and **its availability represents a rare opportunity to push the boundaries of power electronics**. The PhD candidate will have access to state-of-the-art facilities at IEMN for device fabrication and characterization, as well as the opportunity to collaborate with leading researchers at NC State.

Research Tasks:

The successful candidate will be responsible for:

1. **TCAD Simulation:** Using advanced Technology Computer-Aided Design (TCAD) tools to model and optimize the performance of vertical AlN power devices, including their electrical and thermal characteristics.
2. **Device Fabrication:** Fabricating the devices in the cleanroom facilities at IEMN, utilizing processes such as epitaxial growth, lithography, etching, and metallization.
3. **Device Characterization:** Conducting comprehensive electrical and structural characterization of the fabricated devices to evaluate their performance and validate the simulation results.

Candidate Profile:

We are seeking a highly motivated candidate with a strong background in electrical engineering, physics, materials science, or a related field. Prior experience in semiconductor device fabrication, TCAD simulation, or wide-bandgap materials is highly desirable. The candidate should possess excellent analytical and experimental skills, as well as the ability to work independently and collaboratively in an international research environment.

Collaboration and Opportunities:

This project offers a unique opportunity to work at the forefront of semiconductor research, with access to cutting-edge facilities and expertise from both IEMN and NC State. The candidate will benefit from a dynamic and interdisciplinary research environment, as well as the chance to present their work at international conferences and publish in high-impact journals.