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Postdoctoral fellowship in Metz (France)

Extract relevant information from surface characterization techniques.

– Contrast modeling for microstructural defect characterizations –

The postdoctoral researcher will be part of the local team of the HORIZON project AddMorePower (Advanced modeling and characterization for power semiconductor materials and technologies), granted up to 6 M€ over 48 months by the European Commission.

AddMorePower aims to advance x-ray- and electron-probe related characterization techniques to make them quantitative and automated tools for the power semiconductor industry, and to refine modelling and data-management methods to enhance and efficiently use characterization data. Thereby, AddMorePower will promote the materials integration and development for European power semiconductor technologies, to allow a broader and faster market penetration, while also providing new opportunities for other industries basing themselves on mono- and poly-crystalline materials. With the rapid and massive spread of power electronics and power semiconductors to enable the digitalization and the electrification of our society and its supply with sustainable energy, new requirements arise to the conception and integration of semiconductor and interconnect materials. The project brings together renowned research institutes with many years of experience in electron- and x-ray characterization, emerging new research groups and company start-ups and researchers with a track record in multi-physics materials modelling as well as data engineering.

Scanning Electron Microscopy (SEM) can generally be used to characterize microstructural defects in crystalline materials. Electron Channeling Contrast Imaging (ECCI) allows in the sub-surface (≈ 100 nm deep) of bulk material the direct observation of crystal defects, such as dislocations [1]. This emerging SEM technique has the potential to identify contrast changes at the surface using specific crystallographic orientation rules and use them to characterize defects in a non-destructive way [2,3] but it is not yet explored for power electronics materials. An in-depth approach for understanding the influence of free surfaces on the crystalline defects configurations is required when using surface sensitive SEM approaches, such as ECCI. Plasticity features at the surface, such as dislocation structures, can be radically different from those in the bulk. Discrete Dislocation Dynamics (DDD) [4] simulations for GaN will be used to derive contrast images that can be compared to experimental data. Computer vision will be considered to improve the reconstruction of the full (tensorial) dislocation information from 2D data.

[1] H. Kriaa, A. Guitton, N. Maloufi; SCIENTIFIC REPORTS, 2017 (9742)
[2] H. Kriaa, A. Guitton, N. Maloufi; MATERIALS, 2019, 12 (10), 1587
[3] H. Kriaa, A. Guitton, N. Maloufi; MATERIALS, 2021, 14 (7), 1696
[4] A.A. Kohnert, H. Tummala, R.A. Lebensohn, C.N. Tomé, and L. Capolungo; SCRIPTA MATERILIA, 2020,

Your skills

The following qualifications are required:

Excellent knowledge in materials science and mechanics, including plasticity. Experience with computation languages (python, MatLab...) for modelling or simulations.

The following qualifications are beneficial:

Experience in characterization of microstructures by electron microscopy, or in computer vision.

We offer

A 12-month full-time postdoctoral position. The contract is ideally starting on May 1, 2024. The contract includes health coverage and paid holidays. The position offers a dynamic international environment and close supervision by senior scientists. The opportunity to develop to develop experimental and numerical skills (modeling, computer vision, microstructures characterizations…) to foster a career in academia or industry. The gross salary for the postdoc position is approximately 2700 €/month[1].

[1] The median gross salary in France is 2500 €/month (source: French Ministry of Employment, https://code.travail.gouv.fr/outils/simulateur-embauche).

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The local team of AddMorePower:

- **Dr. Vincent TAUPIN**, CNRS research scientist HdR, expert in continuum modeling of materials mechanics]
- **Dr. Antoine GUITTON**, tenured associate professor HdR at Université de Lorraine & Adjunct Associate Professor at Georgia Institute of Technology school of Materials Science and Engineering (USA), expert in microscopy and materials physics. [www.antoine-guitton.fr]
- **2 doctoral researchers**

Host laboratory of the doctoral researcher:

The LEM3 laboratory (***L**aboratoire d'**É**tude des **M**icrostructures et de **M**écanique des **M**atériaux:* Laboratory of Study of Microstructures and Mechanics of Materials) is a joint research center of the Université de Lorraine, the French National Center for Scientific Research (CNRS), and the engineer school Arts et Métiers. LEM3 is one of the largest research institutes for the physics of materials and engineering in France. It is located in Metz, near the tripoint along the junction of France, Germany, and Luxembourg, and forms a central hub for science in Europe. Over 250 scientists from France and around the world work at LEM3 to perform world-class research in materials science, mechanics, and processes. By conducting both fundamental and applied research, researchers at LEM3 work on long-term solutions for the major challenges facing society, industry, and science.

Advantages of working at the LEM3:

As a valued member of our team, you will have access to the comprehensive social protection system in France, including:

- **Universal healthcare coverage:** Universal healthcare coverage: Our comprehensive healthcare system ensures that all necessary medical treatments, including doctor visits, prescription drugs, and hospital stays, are covered with a reference reimbursement rate of around 90% on average (thanks to the *Alsace/Moselle* local regime).
- **Generous annual paid leave:** Take advantage of the LEM3's generous annual leave policy, which allows you to take up to 45 days of annual leave to recharge and rejuvenate.
- **Retirement pensions:** Contribute to the French retirement system and enjoy a pension when you reach retirement age.
- **Unemployment benefits:** when your contract ends, you may be eligible for unemployment benefits to help you cover your expenses while you search for new employment.
- **Sickness benefits:** If you are ill or injured, you may be eligible for daily sickness benefits to cover your lost income.
- **Maternity, paternity, and family leave:** Take time off to care for your family and bond with your new child.
- **Professional training and development opportunities:** Take advantage of the many professional training and development opportunities available in France, to improve your skills and advance your career.
- **Free education:** Education is free in France for children up to 18 years old.
- **Personalized housing allowance:** Assistance for housing costs for low-income individuals.
- **Participation in your public transportation subscription:** 50% of your subscription fees to public transportation for your commute will be supported by the Université de Lorraine.

It is important to note that the level of financial assistance provided by the state may vary depending on your income and the composition of your household.

Application:

Please send a detailed CV and a cover letter to the two email addresses provided in the header. Recommendation letters are not required, but please include the contact information of your references.

Applications without the requested attachments may not be considered.