

PhD position from January 2024 on Molecular Dynamics Modelling of Epoxy/Metal Interfaces

Short Description

The PhD position on molecular-dynamics simulations of thermomechanical behaviour of epoxy-copper interfaces is available starting from **January 2024** in the Soft Matter and Biological Physics (SMB) group of the Applied Physics department of TU/e. The project will be supervised by prof. dr. Alexey Lyulin, <http://tps.phys.tue.nl/lyulin/>

Challenges in integration, miniaturization, and operability in robotics, pharmaceuticals, microelectronics and lithography require high-precision motion systems. In the semiconductor lithography industry, it is predicted that throughput of high-precision motion systems will strongly increase while decreasing the positioning error. To achieve this, it is required to have high coil currents and water-cooling flow rates which lead to accelerated failure of the actuators. The mechanisms of failure due to thermo-electrostatic loads and the role of the microstructure of the potting material/coil complex are currently not well understood, which hampers the development of electromagnetic actuators with an economically viable and reliable lifetime. Therefore, there is a stringent need for a fundamental and conclusive understanding of failure processes in actuators and physical interactions affecting actuator subcomponents.

Job Description

Actively cooled electromagnetic actuators are prone to failure by delamination of interfaces between the coils and the polymer-based potting material, which serves both for heat conduction and mechanical integrity of the actuator. The objective of the planned **molecular-dynamics computer simulations** is to develop a fundamental, qualitative, and quantitative understanding of the mechanisms that lead to failure of these systems and in particular the role of the microstructure at nanoscales and its interaction with the electrostatic actuation and thermal load cycles. For this purpose, multiscale molecular-dynamics modelling, both on a fully-atomistic and on coarse grained levels, will be carried out for the interfaces between epoxy resin (insulating material) and copper electrodes. The research should be performed in a close collaboration with the group Mechanics of Materials, Department of Mechanical Engineering of TU/e, where combined experimental and multi-scale modelling approach will be adopted that accounts for the two-way interaction between the microstructure and the applied multi-physical loads resulting from the electromagnetic actuation.

Job Requirements

Talented, enthusiastic candidates with excellent analytical and communication skills holding university degree (MSc, with high grades) in Physics, Physical Chemistry or Chemical Engineering, with an acute interest in statistical mechanics and soft matter physics, and an affinity (and preferably some exposure) to the application of numerical methods, are encouraged to apply. Experience in multi-scale modelling and (some) knowledge of Gromacs and/or LAMMPS packages is of benefit.

Conditions of Employment

The position is fixed term for a period of four years, starting in January 2024. We offer a meaningful job in a dynamic and ambitious university, in an interdisciplinary setting and within an international network, in close collaboration with industries as ASML and Tecnotion. You will work on a beautiful, green campus within walking distance of the central train station. In addition, we offer you:

- Full-time employment for four years, with an intermediate evaluation (go/no-go) after nine months. You will spend 10% of your employment on teaching tasks.
- Salary and benefits (such as a pension scheme, paid pregnancy and maternity leave, partially paid parental leave) in accordance with the *Collective Labour Agreement* for Dutch Universities.
- A year-end bonus of 8.3% and annual vacation pay of 8%.
- High-quality training programs and other support to grow into a self-aware, autonomous scientific researcher. At TU/e we challenge you to take charge of your own [learning process](#).
- An excellent technical infrastructure, on-campus children's day care and sports facilities.
- An allowance for commuting, working from home and internet costs.
- A Staff Immigration Team and a tax compensation scheme (the 30% facility) for international candidates.

Information and application

About us

Eindhoven University of Technology is an internationally top-ranking university in the Netherlands that combines scientific curiosity with a hands-on attitude. Our spirit of collaboration translates into an open culture and a top-five position in collaborating with advanced industries. Fundamental knowledge enables us to design solutions for the highly complex problems of today and tomorrow.

Information

For more information please contact prof. dr. Alexey V. Lyulin, group Soft Matter and Biological Physics (SMB), Department of Applied Physics and Science Education (APSE), Eindhoven University of Technology, email a.v.lyulin@tue.nl. Please mention the reference *Regenerate*.

Information on the SMB group can be found on the website <https://www.tue.nl/en/research/research-groups/soft-matter-and-biological-physics>

Visit TU/e website for more information about the [application process](#) or the [conditions of employment](#).

Application

If interested in applying, please send an email to a.v.lyulin@tue.nl with:

- Cover letter in which you describe your motivation and qualifications for the position. Applications without a motivation will not be taken into consideration.
- Detailed curriculum vitae including photograph, transcripts of BSc and MSc degrees (with grades), and contact information of two potential referees.

We look forward to receiving your application and will screen it as soon as possible. The vacancy will remain open until the position is filled.