The Cluster of Excellence livMatS develops novel, bioinspired materials systems that adapt autonomously to various environments and harvest clean energy from their surroundings. The intention of these technical – yet in a behavioral sense quasi-living – materials systems is to meet the societal grand challenges with environmental and energy technologies. The research program of livMatS is characterized by highly interdisciplinary collaboration between researchers from a broad range of fields including engineering, chemistry, physics, biology, psychology, the humanities, and sustainability sciences.

The livMats Cluster of Excellence is offering 1 PhD position for the project: Programmable Triboelectric Energy Harvesting through Mechanical Design (TriboMech)
Envisaged start date: as soon as possible

Project description
Surfaces often become charged after contact, a phenomenon called triboelectricity. In triboelectric generators (TENGs) charging is exploited during a repetitive contact and separation of metals, semiconductors and insulators to harvest energy. Among the physical parameters influencing the performance of a TENG are contact force, chemical and/or physical properties of the mating surfaces, as well as speed and dynamics of contact formation and release.

This project will investigate the role of mechanical properties on the generator efficiency using simple tabletop experiments and (analytical and numerical) theory. The idea is that the contact separation velocity is important to freeze-in the charge separated state. Contact separation occurs by interfacial cracks, whose dynamics we seek to understand and control through material properties and patterning. Experiments and theory are closely related to adhesive contact mechanics.

Within this project, a second doctoral student will work on building a TENG demonstrator. Close cooperation is expected and will be of mutual benefit. Yet another livMatS project is working on chemical surface effects in a TENG, with additional cooperation opportunities.

Candidate profile
We are looking for a candidate with a university degree in mechanical engineering, physics, materials science, microsystems engineering or a comparable subject. Your qualification will cover several of the following areas:
- basic understanding of solid mechanics/micromechanics
- basic understanding of the theory of cracks (fracture mechanics) and contact mechanics
- basic numerical programming (preferably Python)
- experience with experimental testing of mechanical properties
- experience in the programming and operation of computer-controlled lab equipment (e.g. LabView) and measurement equipment (power supplies, multimeters, oscilloscopes)
Please hand in:

- Letter of intent detailing why you are interested in the project and how your previous research qualifies you for the project (up to 1,500 words)
- Curriculum Vitae with list of publications (if applicable)
- Certified copies of your university degree(s) with grades (BA and MA certificate / Diploma certificate and transcript)
- Short summary of your master’s thesis (up to 1,000 words)
- Work sample (chapter from recent thesis or journal article, up to 5,000 words)
- Suggestion of two referees with contact details

Your documents will not be returned after the application process. For this reason, please submit copies only. This position is limited to 36 months. The salary will be determined in accordance with TV-L E13. We are particularly pleased to receive applications from women for the position advertised here.

Please send your application in English including supporting documents mentioned above citing the reference number 00002624 by December 31, 2022. Applications are to be emailed to positions@livmats.uni-freiburg.de (please send one MERGED PDF file):

Direct questions about the science of the project to:
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