Postdoctoral position

Multiscale damage mechanisms in nano-enabled devices: multiphysics characterization and modeling

Background

Ecole Polytechnique, in collaboration with IFSTTAR, has developed a series of nano-enabled devices for Smart Cities applications, such as water quality monitoring with carbon nanotubes sensors or road monitoring with carbon-clay nanoparticles sensors. While these technologies attract industrial partners, their deployment in the field raise various questions and challenges about the Physics of Ageing in such devices. In particular, the damage mechanisms arising in the devices at the macro, micro and nano scales are yet to be investigated and understood depending on the external loadings. Another crucial issue is to establish whether these phenomena can be predicted so as to estimate lifetime and reliability in nano-enabled devices.

Proposed research

LMS (Solid Mechanics Laboratory) and LPICM (Physics of Interfaces and Thin Films Laboratory) at Ecole Polytechnique have developed an experimental platform dedicated to the study of such mechanisms (see https://portail.polytechnique.edu/platine/), notably including state-of-the-art equipment such as a high-resolution infrared camera, a multi-loading (electrical-mechanical-thermal-hydric) bench, in-situ SEM… The devices under investigation are mostly based on percolating networks of conducting nanoparticles on rigid or flexible substrates, which can be fabricated in-house or provided by partners.

Based on this platform, the objectives of the proposed postdoctoral project is to understand the multiscale damage arising in nanodevices under various types of loadings, in view of proposing lifetime models of the devices.

Because damage can be related to temperature variations in the devices, the starting point of the project is to conduct high-resolution thermal imaging under thermal, electrical and environmental loadings to detect hotspots related to ageing. These experiments will then be supplemented with higher resolution imaging techniques such as in-situ SEM, AFM or NanoRaman microscopy to identify the nanoscale causes for damages. The findings will be integrated into multiscale models of the devices developed in the team in view of understanding quantitatively the impact on device performance over time.

Application

The successful candidate will have a strong background in nanophysics and nanocharacterization, preferably infrared imaging, and will be knowledgeable in mechanical concepts and physical modeling tools. Application packages will include a research statement, a CV with a list of publications and the contact information of at least two references.

Starting date: from September 1st 2017. Deadline for application: July 20th 2017.

Information

Position located in greater Paris area: Ecole Polytechnique, Route de Saclay, 91128 Palaiseau, France

Salary: depending on experience, starting at 2000€/month net

Duration: 18 months, renewable once

Contact

Laurence Bodelot – laurence.bodelot@polytechnique.edu

Bérengère Lebental – bérengère.lebental@polytechnique.edu