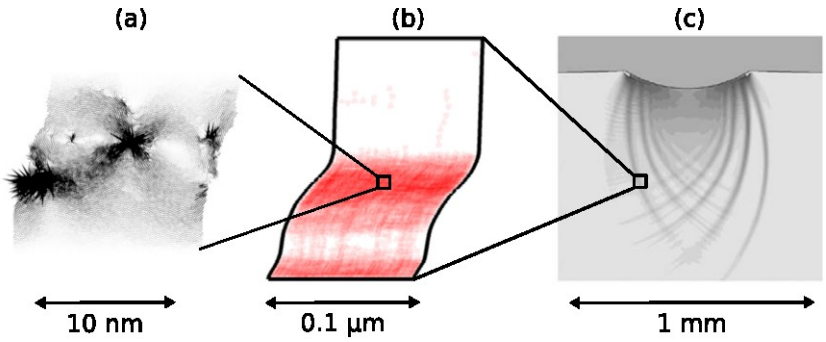
POSTDOCTORAL RESEARCH POSITION

Multi-scale Modeling of Plasticity in Amorphous Solids

At Lab. PMMH (www.pmmh.espci.fr), CNRS/ESPCI/Paris 6/Paris 7, Paris, France

Objectives of the project and context

Countless applications, from the development of new materials to the design of structures, stem from our ability to control the properties of matter. This capacity depends directly on our understanding of the mechanisms explaining its mechanical properties. Over the past thirty years, thanks in particular to the surge in multi-scale methods, the modeling of the mechanical properties of materials has seen remarkable advances. These advances are nevertheless much more modest in the case of highly disordered materials, especially amorphous materials [1]. However, these materials are omnipresent in our everyday environment and have remarkably similar mechanical behaviors, which calls for a global understanding. This is the aim of this research project which intends, via a theoretical and numerical approach, to derive physically justified constitutive laws, i.e. with the least number of adjustable parameters. On the basis of a new method allowing to sample the atomic relaxations [2], we propose to reconsider the multi-scale modeling method for glassy solids. By providing the elementary building block missing so far, this method will improve the modeling of the mechanical and thermal loading effects on the mechanical properties.



Multi-scale modeling strategy [1]. The plasticity of amorphous materials is studied at different scales: (a) atomic, (b) mesoscopic and (c) continuous. So far, the absence of quantitative link between local structure and plasticity at the atomic scale has confined this approach to a qualitative description. A new method developed by our group has just addressed this scientific challenge [2], opening the way to a better understanding of the mechanical properties of glassy materials.

[1] D. Rodney, A. Tanguy and D. Vandembroucq, *Modeling the mechanics of amorphous solids at different length scale and time scale*, Model. Simul. Mater. Sci. Eng. **19**, 083001 (2011).
[2] S. Patinet, D. Vandembroucq and M.L. Falk, Connecting local yield stresses with plastic activity in a model amorphous solid, Phys. Rev. Lett. **117**, 045501 (2016).

Job description

The hired postdoc will be part of a multi-scale research project focused on the mechanical properties of amorphous materials. Project efforts will focus on the characterization and modeling at mesoscopic and/or continuous scales, via numerical and theoretical approaches, depending of the background of the candidate. Using a coarse-grained approach, we will derive a constitutive law in the c*ontinuum* mechanics framework, in accordance with the results harvested at atomic scales. A sustained dialogue with the other members of the group studying atomic level mechanics is therefore strongly desired to make the different approaches on different scales “feed” each other, the multi-scale aspect being a key point in this project.

The appointment of postdoctoral fellow will be for 18 months. We envisage a starting date in September 2018, but this is flexible. The salary is around 2300€ per month after taxes.

Desired skills and experience

Eligible candidates should hold a Ph.D degree in Solid State Physics, Mechanics, Materials Science or a closely related discipline, with expertise/experience in simulations of mechanical systems and good skills in programming (e.g. FORTRAN, C, Python etc.). An experience in molecular dynamics, in finite element method or in solid mechanics modeling is considered as a plus.

About the employer

This postdoc project will be carried out within the PMMH (Physics and Mechanics of Heterogeneous Media) CNRS laboratory doing research on fluid and solid mechanics (engineering), physics and also biology. The laboratory is located on the Jussieu Campus in the Latin Quarter of the 5th arrondissement of Paris, France. The team where the postdoc will be hired is skilled on mechanics, physics of heterogeneous media and muslti-scale modeling. For details on the research being pursued in our laboratory, please look at our laboratory website: www.pmmh.espci.fr

Application procedure

Application in English must be submitted electronically by sending an email with “Apply for ANR JCJC postdoc” as a subject to sylvain.patinet@espci.fr. The application must include the following:

- Complete curriculum vita.
- Complete list of publications.
- Description of current research and a cover letter.
- Full contact information (name, address, telephone & email) of three professional referees who may be contacted for references.

Contacts

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