

Two PhD positions in Modelling Hydrogen-Material Interactions

The Department of Structural Engineering has vacancy for

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About the positions

Department of Structural Engineering has vacancy for 2 PhD fellowship positions. The first PhD position (PhD 1) is supported by the project "**Safe Pipelines for Hydrogen Transport (HyLINE)**" financed by the ENERGIX program of the Research Council of Norway and industrial partners from the energy and renewable energy sectors. The second PhD position (PhD 2) will work in the project "**Multiscale Hydrogen Embrittlement Assessment for Subsea Conditions (M-HEAT)**" financed by the PETROMAKS II program of the Research Council of Norway and industrial partners.

The **HyLINE** project will address pipeline material challenges related to transporting clean hydrogen gas in the existing subsea pipeline infrastructure for natural gas transport and new pipeline infrastructure. Driven by the prioritized industrial needs of structural integrity and life extension, and powered by multiscale simulations and experiments, the **M-HEAT** project will establish quantitative hydrogen embrittlement tools for engineering materials exposed to subsea conditions, by deriving mechanism-based hydrogen-induced failure criteria and forging the transferability from lab scale tests to industrial components.

Both PhD candidates will work at NTNU Nanomechanical Lab www.ntnu.edu/nml, chaired by Professor Zhiliang Zhang, Professor Jianying He and two adjunct professors from the industry. In 2018, there were 18 PhD students and 3 post-doc fellows working in the NTNU Nanomechanical Lab. More than 28 international journal papers were published by the students and post docs at NTNU Nanomechanical Lab last year, including papers at top journals such as *Nano letters*, *Materials Horizons*, *Nanoscale*, *Acta Materialia* et al.

Both positions report to the main supervisor [Professor Zhiliang Zhang](#).

Job description

When metallic materials are exposed to hydrogen environment, hydrogen can diffuse into the metals, interact with microstructure and deformation, and cause material degradation (i.e. hydrogen embrittlement) that may lead to premature failure with catastrophic consequences. Hydrogen embrittlement is a long-standing challenge for both the traditional energy industry as well as the renewable energy sector. It is a critical failure mode that must be considered in securing the material integrity and developing the life extension strategy of structural components.

PhD1 will work on continuum-based modelling of hydrogen embrittlement. In particular, together with the project team, the PhD candidate will establish hydrogen-informed predictive models by extending the Gurson model to account for the embrittlement effect of hydrogen on ductile damage characterized by microvoid nucleation, growth and coalescence. The candidate will work closely with SINTEF and University of Poitiers.

The objective of the PhD2 is to study the hydrogen-microstructure-deformation interactions by atomistic simulations, and based on the atomistic simulation results to develop mechanisms-based continuum scale hydrogen failure criterion. The PhD candidate will work closely with Oxford University, UK and Caltech, USA.

Qualification requirements

The PhD-position's main objective is to qualify for work in research positions. The qualification requirement is completion of a master's degree or second degree (equivalent to 120 credits) with a strong academic

background in applied mechanics, mechanical/structural engineering, material physics, material science, or equivalent education with a grade of B or better in terms of NTNU's grading scale.

For the PhD 1, experience and knowledge of continuum mechanics and finite element method are essential. For PhD 2 experience and knowledge of molecular dynamics simulation will be a great benefit.

Applicants with no letter grades from previous studies must have an equally good academic foundation. Good English skills, spoken and written, are required. Applicants who are unable to meet these criteria may be considered only if they can document that they are particularly suitable candidates for education leading to a PhD degree.

The appointment is to be made in accordance with the regulations in force concerning State Employees and Civil Servants and [national guidelines for appointment as PhD, post doctor and research assistant](#).

Personal characteristics

- Motivated and ambitious students with excellent grades
- Ability to work both individually and in a team environment and a high level of personal responsibility
- excellent communication skills in scientific writing and oral presentation
- Eager to disseminate research results through publications and presentations at international conferences.

In the evaluation of which candidate is best qualified, emphasis will be placed on education, experience and personal suitability, in terms of the qualification requirements specified in the advertisement

We offer

- an experienced and supportive PhD supervising team
- a socially active international group full of positive energy
- exciting and stimulating Fridays seminars
- a network with international leading research groups
- an open and inclusive work environment with dedicated colleagues
- favourable terms in the [Norwegian Public Service Pension Fund](#)
- [employee benefits](#)

Salary and conditions

PhD candidates are remunerated in code 1017, and are normally remunerated at gross from **NOK 449 400** (approximately **47000 Euro**) per annum before tax. From the salary, 2% is deducted as a contribution to the Norwegian Public Service Pension Fund.

The period of employment is 3 years. Appointment to a PhD position requires admission to the PhD programme in Engineering <https://www.ntnu.edu/studies/phiv>. As a PhD candidate, you undertake to participate in an organized PhD programme during the employment period. A condition of appointment is that you are in fact qualified for admission to the PhD programme within three months.

Appointment takes place on the terms that apply to State employees at any time, and after the appointment you must assume that there may be changes in the area of work.

General information

Working at NTNU

A good work environment is characterized by diversity. We encourage qualified candidates to apply, regardless of their gender, functional capacity or cultural background. Under the Freedom of Information Act (Offentleglova), information about the applicant may be made public even if the applicant has requested not to have their name entered on the list of applicants.

Questions about the position can be directed to Professor Zhiliang Zhang, phone number +47 93001979, e-mail zhiliang.zhang@ntnu.no.

About the application:

Publications and other academic works that the applicant would like to be considered in the evaluation must accompany the application. Joint works will be considered. If it is difficult to identify the individual applicant's contribution to joint works, the applicant must include a brief description of his or her contribution.

Please submit your application electronically via www.jobbnorge.no with your CV, diplomas and certificates. Applicants invited for interview must include certified copies of transcripts and reference letters. Please refer to the application number **IV-110/19 for PhD 1** and **IV-111/19 for PhD 2** when applying.

Application deadline: 20.03.19