

## PhD position: Numerical modeling of plasmas for methane conversion

*We seek a PhD student to work on methane conversion using plasma.*

*The research will be primarily based on numerical modeling and simulation - the candidate will perform analysis of chemical reaction pathways and transport in synergy with state-of-the art laser diagnostics at Maastricht University to develop a comprehensive understanding of the underlying physical and chemical processes occurring in the plasma.*

### PROJECT DESCRIPTION

The chemical industry urgently needs to cut its CO<sub>2</sub> emissions. *Electrification* will reduce emissions from processes by powering them with renewable electricity in place of fossil fuels. *Circular processes* will reuse valuable resources (e.g. plastics), and in doing so will cut end-of-life emissions and reduce resource depletion rates. We research novel *plasma technologies* to facilitate both electrification and circular processes for the chemical industry. In future, industry expects to have an environmentally sustainable source of methane, which can be most effectively valorized via upgrading to ethylene; a crucial feedstock in the production of plastics. However, methane-to-ethylene conversion is notoriously difficult, as it is a strongly endothermic reaction with highly complex chemistry. Thermal plasma technology is a promising approach for methane to ethylene conversion as it allows the possibility for high efficiency, excellent reactant conversion, and refined product selectivity.

Plasma chemistry modelling is extremely challenging. This is due to the high number of species (electron, ions, radicals, molecules) and their reactions and dynamics, which occur over multiple time and length scales. Gas heating, transport, and electromagnetic power coupling also need to be incorporated. Additionally, consideration of the non-equilibrium between electrons and other species is critical; requiring specific methodologies to describe electron kinetics. The project aim is to develop a plasma model to simulate plasma driven reforming of methane.

### JOB DESCRIPTION

The successful candidate is expected to perform numerical simulations to evaluate chemical and physical processes occurring in methane plasma discharges. You will work independently to develop code, collect, analyze, and evaluate results and compare them with experimental measurements. Code validation and characterization with respect to numerical and physical parameters is also an essential part of the job.

You will join a small team working on experiments and similar numerical models. We expect that you will regularly discuss, share, and present your work with fellow team members, colleagues, and wider audiences at international conferences. We expect you will write a number of high-quality scientific articles, ultimately culminating in your PhD thesis.

### REQUIREMENTS

We seek motivated and highly talented candidates with a Master degree (or an equivalent diploma giving access to doctoral studies) in Physics or Chemistry. The applicant should have:

- General knowledge of low temperature plasmas
- Knowledge of computational modelling
- Good programming skills (e.g. Fortran, C, C++) are essential as just like
- Good communication skills in English (both written and spoken).

## CONDITIONS OF EMPLOYMENT

- We offer a rewarding career at a young university in the heart of Europe, with a distinct global perspective and a strong focus on innovative research and education;
- The terms of employment of Maastricht University are set out in the Collective Labour Agreement of Dutch Universities (CAO), supplement with local UM provisions. For more information on terms of employment, please visit our website [www.maastrichtuniversity.nl](http://www.maastrichtuniversity.nl) > Support > UM employees;
- Your salary would be € 2.395,- gross per month in the first year up to € 3.061,- gross per month in the fourth year according to the PhD-candidate salary scale. (Based on a full-time appointment). On top of this, there is an 8% holiday allowance and a 8.3% year-end allowance;
- We offer an attractive package of fringe benefits such as reduction on collective health insurance, substantial leave arrangements, optional model for designing a personalised benefits package and application for attractive fiscal arrangements for employees from abroad.

## CONTRACT TYPE

### **PhD**

We offer a full-time employment contract as a PhD candidate. The employment contract will be for a period of 1 year and will be extended for another 3 years after positive evaluation.

## EMPLOYER

Located in the heart of Europe, UM is the most international university in the Netherlands with half of our students and one third of academic staff coming from abroad. In total, UM has around 18.000 students and 4,300 employees and represents 100 different nationalities. Maastricht University is a stimulating environment where research and teaching are complementary, where innovation is our focus and where talent can flourish. Research is characterized by a multidisciplinary, thematic, and collaborative approach, and with education, forms the core of UM.

Not convinced/Eager to learn more? Take our virtual [campus tour](#) to get a sense of our university culture, the city of Maastricht, and your potential working environment.

### **Faculty of Science and Engineering**

The Faculty of Science and Engineering (FSE) is home to several outstanding departments and institutions covering education and research in Science, Technology, Engineering and Mathematics (STEM) as well as the liberal arts and sciences.

## DEPARTMENT

We are part of the newly created Circular Engineering Department in the Faculty of Science and Engineering at Maastricht University. Our research group is uniquely situated in the heart of the Dutch chemical industry at the Brightlands Chemelot campus, 20 km north of Maastricht. Our strong links with industry give excellent opportunity to build collaborations and partnerships, giving good prospects for a future career in industry. Our group has a strong expertise in plasma science, with each of our respective

members having an established international reputation for high quality scientific output in the fields of plasma chemistry, plasma modelling, spectroscopy, and laser diagnostics. We have excellent international connections with esteemed laboratories, and we therefore expect the applicant will have the opportunity to work abroad during their PhD.

### **ADDITIONAL INFORMATION**

In case you are interested you can apply by electronically submitting an application letter and a full curriculum vitae (including names and e-mail addresses of maximum 3 persons who could act as your references), a grade list and possibly copies of papers to [p.diomede@maastrichtuniversity.nl](mailto:p.diomede@maastrichtuniversity.nl). Please use the following format for your documents:

lastname\_applicationletter.pdf

lastname\_cv.pdf

lastname\_gradelist.pdf

lastname\_papers.pdf

More information on this vacancy can be obtained from Dr. Paola Diomede ([p.diomede@maastrichtuniversity.nl](mailto:p.diomede@maastrichtuniversity.nl))

### ***DIVERSITY STATEMENT***

Maastricht University is an international organization, embracing a diverse student and staff population. We strongly believe that diversity is our advantage and creating an inclusive working climate in which students and staff feel a valued member of the UM community is therefore a top strategic priority. UM values [diversity](#) within its community and encourages you to apply.