Design & characterization of promising zeolite catalysts for dilute methane removal for greenhouse gas mitigation. 1 PhD position, fully funded (4 years).

Aim

Through mechanistic understanding, derive new strategies and material properties to achieve improved total methane oxidation catalysis compatible with dilute, low temperature methane emission streams.

Context

Methane is a potent greenhouse gas, with an especially strong impact on global warming on the short term. Unfortunately, methane emissions are still on the rise, and more so than has long been thought. Recent state of the art tracking technologies have revealed this as an underestimated problem, which will moreover be challenging to tackle using existing technology. Reducing atmospheric methane concentrations has therefore become an urgent concern to the international community, with the challenge emphasized in recent IPCC reports and on various other monitoring platforms.

A novel strategy seeks to address the challenge through innovative reactive trapping. A highly reactive oxygen site on the surface of a heterogeneous catalyst is used to oxidise the relatively inert methane molecule as an adsorbed first oxidation product, effectively ‘oxidatively trapping’ the methane. The most promising materials for this are zeolites with specialized copper and iron active sites. To make these materials work for the intended purpose, certain fundamental hurdles must still be overcome. This requires a better understanding of some of the reaction steps on the catalyst surface.

In this PhD you will use state of the art spectroscopic and kinetic characterisation techniques to develop such understanding. You will join a consortium of researchers from UGent, KU Leuven and Stanford University at the forefront of their research field, and with decades of experience on these copper and iron active sites. In your role you will complement the research of your research partners with characterisation techniques (TAP, modulation excitation spectroscopy, operando XAS, …) that they have not applied to these catalysts before. You will work closely with a PhD student at the nearby KU Leuven, regularly discussing the project, exchanging results and samples, and co-authoring research articles. Your collaborators will complement your PhD with their expertise in synthesis, catalytic testing, (other types of) advanced spectroscopy, and computational chemistry techniques.

Initial overlap with senior PhD students, at KU Leuven as well as UGent, is ensured to enable efficient knowledge transfer of practical knowledge.

Program and job description

- Under the supervision of professor Galvita and a senior postdoctoral researcher (Max Bols), you will prepare a PhD dissertation over a duration of about 4 years. In these 4 years you publish and present results both at international conferences and in scientific journals.
- You will unravel the kinetic role of the various active sites and their interactions. You will in particular become an expert in modulation excitation-DRIFTS, other modulation excitation spectroscopies, and temporal analysis of products (TAP)
- You will participate in synchrotron campaigns
- You will assist the research group with limited educational tasks in topics related to your research.
- Research stays with collaborators (as already specified in the project or when new needs arise during the project) are anticipated and encouraged where useful

Advisors

- Vladimir Galvita
- Max Bols

Funding

FWO

Candidate Profile

Requirements

- Holder of a Master degree in Chemistry, Chemical engineering, or similar.
- Strong analytical skills and some experience with catalysis, reactor design and kinetics
- A strong interest in physical chemistry
- You work independently and have a strong feeling of responsibility both for you project and for lab safety
- A good proficiency in English (oral and written)

How to apply and application process

Apply before **15 January 2025** by sending an email to vacatures.galvita@ugent.be. Your application should include:

- your resume (curriculum vitae)
- motivation letter (< 1 page)
- a copy of your diploma and diploma supplement (with overview of all courses followed)

Qualified candidates will be invited for an interview as applications are evaluated. In a standard procedure, the first round consists of a short call to validate the application, the second round is a longer interview (~1 hour), and the final round is an assessment by a panel of staff at the Laboratory for Chemical Technology.

While we try to send a response to all applicants, if you do not hear back within two weeks, you have likely not been selected.

This PhD vacancy is available from 1 January 2025, and will remain open until the vacancy is filled. The position is not open for post-docs.

More information: vladimir.galvita@ugent.be and/or max.bols@ugent.be

A Ph.D. at UGent and the LCT

We offer a challenging, stimulating, young and pleasant research environment where you can contribute to solving real-life problems, delivering technological innovations with clear societal and economic value. The UGent doctoral school program offers possibilities to follow a range of courses or trainings of your interest. We foresee a competitive remuneration and the possibility to obtain a PhD degree in Engineering. You will receive a PhD grant for 4 years, with an evaluation after the first year (1+3 contract).

This PhDs offers a unique opportunity to dedicate yourself to fundamental research questions in catalysis in an applied, globally relevant, and collaborative framework. Your workplace (LCT) is an international environment with intense contacts with industry, and with professionally engineered and operated experimental facilities. the LCT is embedded in the University of Ghent, a world-renowned research university. The V. Galvita research group focuses on understanding heterogeneous catalysis through techniques and methodologies that extend the state of the art. The group operates one of the few TAP setups found worldwide, develops modulation excitation techniques, and embarks frequently on synchrotron campaigns for operando studies. The lab offers opportunities to guide master students and to support education. Your co-supervisor, dr. Max Bols, has worked on the topic since 2015 at UGent, KU Leuven and Stanford University.

The offer includes:

- A 100% PhD Scholarship (1+3, contingent on positive evaluation after Y1).
- Full-time employment with 36 days of holiday leave per year.
- Well-equipped labs with experimental and computational facilities
- A pleasant work climate and collegial atmosphere in an international and interdisciplinary research team.
- Weekly (at least) contact with your colleagues and supervisors to share your knowledge, discuss the problems you might have, and collaborate on a solution.
- Optional social activities are typically organized by the team members and supported by the lab.
- You will be allowed to travel abroad (conferences) to communicate your scientific breakthroughs.
- A huge training offering (Doctoral Schools) that supports you during your PhD and prepares you for your future career.
- Bicycle allowance, benefits regarding public transport.
- Above all we offer you a Ph.D. degree with very good credentials for future employment.

Fellowship: ~ € 31.000 net per year including health insurance and other social security benefits. (scholarship exempt of taxes)

More information:

https://www.ugent.be/phd/en

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