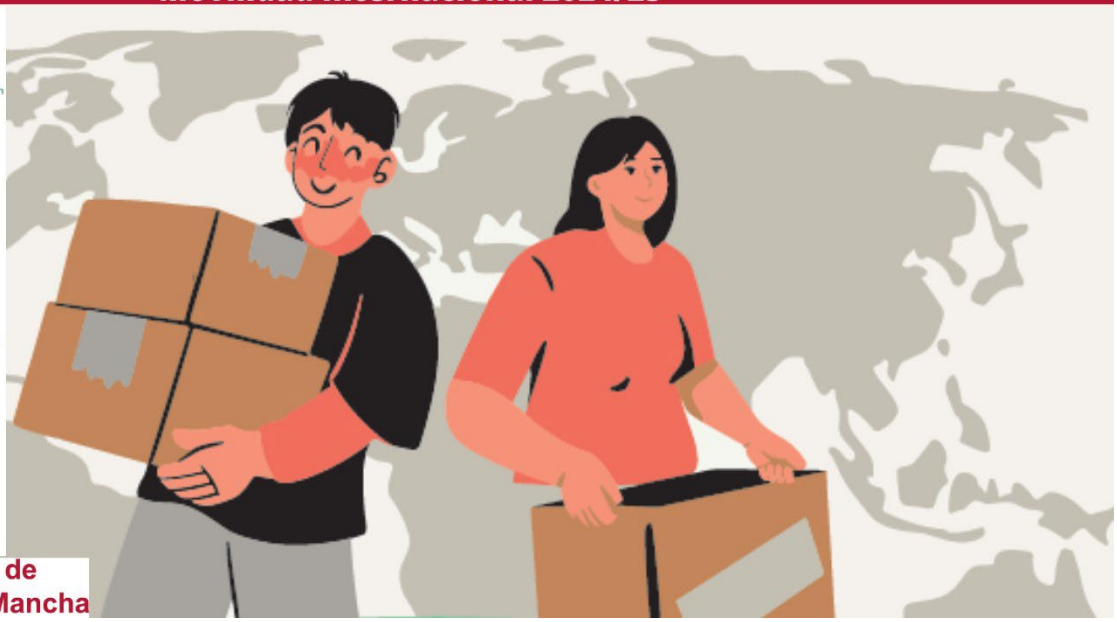
PRÁCTICAS ASOCIACIONES CIENTÍFICOS ESPAÑOLES

CONVOCATORIA ERASMUS+ ESTUDIANTES MODALIDAD PRÁCTICAS ABIERTAS

Movilidad Internacional 2024/25



DESTINOS DE PRÁCTICAS OFERTADOS

- **CEBE 01 (BELGICA) Design of an electrothermal fluidized bed reactor – Pag. 2**
- **CEBE 02 (BELGICA) Design of a simulated moving bed for the recovery of unconverted ammonia from an ammonia cracking system for the production of hydrogen – Pag. 6**

FORMULARIO DE PARTICIPACIÓN
EN DESTINOS PRÁCTICAS CEBE 01 y CEBE 02

CONVOCATORIA DE PRÁCTICAS INTERNACIONALES
CALL FOR INTERNATIONAL INTERNSHIP

DEPARTAMENTO/FACULTAD/INSTITUCIÓN Departament/Faculty/Institution

Department of Bioscience Engineering/Faculty of Science

TIPO DE ORGANIZACIÓN Organization type: EPLUS-EDU-HEI

ORGANISMO PUBLICO Public Body: ■ SI Yes ☐ NO

SIN ANIMO DE LUCRO Non-Profit: ■ SI Yes ☐ NO

TAMAÑO Size: >250

WEB: Www.uantwerpen.be

DISPONIBILIDAD PARA EVALUAR INFORMES DE CONVALIDACION DE CREDITOS ECTS
¿Es una prioridad para el supervisor que el estudiante valide los créditos?
Availability to evaluate ECTS credit validation reports
Is it a priority for the supervisor that the student validates ECTS credits?

yes

2. DESCRIPCION DEL PROYECTO Project description

FECHAS ORIENTATIVAS DE REALIZACION DEL PROYECTO
Wished/approximate dates for the mobility period

To be discussed

FLEXIBILIDAD DE FECHAS
Flexibility in dates

■ SI yes
☐ NO

TÍTULO DEL PROYECTO Project title

Design of an electrothermal fluidized bed reactor

NUMERO DE HORAS DE TRABAJO POR SEMANA Number of working hours per week

35

PROGRAMA Detailed programme of the traineeship

The electrification of the chemical industry is crucial to reduce the CO2 emissions due to the combustion of fuels to provide the high temperatures required for chemical transformation. An electrothermal fluidized bed (e-FB) is obtained when flowing an electrical current in a fluidized bed of electrically conducting particles: the electrical energy is converted into heat via the Joule effect due to the particles' resistivity. To do so, two electrodes are immersed in the bed. The electrification of FBs is more than a mere heating mechanism: it affects the hydrodynamics of the bed. For the design of e-FB, the heating requirements need to be considered (specific electrical resistance of both the catalysts and electrically conductive particles), on top of the conventional fluidized bed reactor design. The solids composing the bed will be selected, and the solids specific electrical resistance will be characterized using an in-house build apparatus consisting of electrodes connected to a Wheatstone bridge. Using repeated resistance measurements at various interelectrode distances, the electrode-bed contact resistance can be quantified and removed, thus allowing to precisely quantify the bed resistance at the relevant temperature, allowing the selection of a power supply. Thermal and electrical insulation for safe operation will then be designed, followed by all peripherals (gas-preheater, off-gas cooling and cyclones and filters prior to gas analysis). Mixtures of catalysts and conducting particle (carbon, silicon carbide) will also be tested to include the possibility to decouple the reaction and heat transfer functions (different amounts of particles required for heat transfer and chemical conversion).

CONOCIMIENTOS, HABILIDADES Y COMPETENCIAS QUE HAN DE ADQUIRIR LOS ESTUDIANTES
Knowledge, skills and competences to be acquired by the end of the traineeship

The trainee will develop frontier knowledge on the design of electrothermal reactors (know how not available in the open literature), with the strong support of the promotor. The design of the lab-scale e-FB will be performed using an iterative approach combining textbook engineering models for fluidized beds and an electrical-engineering approach (the 'voltammograms approach').
To complete the design, the heating requirements will be considered (specific electrical resistance of both the catalysts and electrically conductive particles). The solids specific electrical resistance will be characterized using an in-house build apparatus consisting of electrodes connected to a Wheatstone bridge.

MONITORIZACION Monitoring plan

The trainee will work under the supervision of Prof Patrice Perreault, and will work in collaboration with 1 senior PhD students and/or postdoc working on this project. Prof Perreault and/or the PhD students/postdoc will train the trainee on the design of fluidized bed reactors, as well as how to include the joule effect. For the first month, the trainee will be in close contact with Prof Perreault, 1-2 days per week. For the remaining period, the trainee will be supervised in the form of a weekly meeting (where he/she will have to present the project advancement), and will spend half a day per week for training.

EVALUACIÓN Evaluation plan

The work will be evaluated during the weekly follow-up meetings. The researchers present their achievements, discuss problems & challenges, as well as proposing a planning for the week to come. In this way, they are confronted to their actual versus planned progress, and to propose corrective measures. If the corrective measures are considered insufficient, we as a group explore other measures (including increasing the workforce involved in a project). These meetings are a platform to exchange and challenge scientific ideas, and for problem solving. The trainee will also be required to summarize her/his ideas in the form of a manuscript.

ESPECIFICACIONES ADICIONALES EN LA INSTITUCIÓN DE ACOGIDA
Additional specifications of the host institution

OTRA INFORMACIÓN RELEVANTE Other relevant information

The trainee will contribute to the advancement of a currently running project, so the host applicant directly benefits by getting help to the delivery of the work packages of the project. The host applicant also benefit by broadening his researchers network, both with the individual students and the sending institution. The trainee will benefit by working in a new state-of-the-art laboratory, fully equipped with
advanced gas analysis (RGA GC, quadrupole mass analyzer), and reactor diagnosis tools (pressure fluctuations, particle image velocimetry, etc.). The trainee will develop his autonomy: as part of this trainee, the trainee will not be asked to plainly do repetitive measurements, but either scientificallyt contribute to the research project, just like the PhD students and postdoc in the group (but of course under supervision). The trainee will be requested to prepare a manuscript, which should be submitted to a Q1 journal in maximum one year timeframe.

3. PERFIL Y REQUISITOS DEL ESTUDIANTE Student profile and requeriments

AREA/S DE ESTUDIO Research area/s

Chemical Engineering

NIVEL DE ESTUDIO Level of studies

Level of studies: 3rd years in process or completed.

REQUISITOS PREVIOS DE CONOCIMIENTOS TECNICOS O EXPERIENCIA
Student required expertise and technical knowledge:

Reactor design and Heat transfer courses completed.

IDIOMA Y NIVEL MINIMO RECOMENDADO PARA REALIZAR LAS PRACTICAS
Language and minimum level recommended for internships

English (the supervisor speaks Spanish)

REQUISITOS ADICIONALES DE LA INSTITUCION DE ACOGIDA
Additional requirements set by the host institution

None

CONVOCATORIA DE PRÁCTICAS INTERNACIONALES
CALL FOR INTERNATIONAL INTERNSHIP

DEPARTAMENTO/FACULTAD/INSTITUCIÓN Departament/Faculty/Institution

Department of Bioscience Engineering/Faculty of Science

TIPO DE ORGANIZACIÓN Organization type: EPLUS-EDU-HEI

ORGANISMO PUBLICO Public Body: ■ SI Yes ☐ NO

SIN ANIMO DE LUCRO Non-Profit: ■ SI Yes ☐ NO

TAMAÑO Size: >250

WEB: Www.uantwerpen.be

DISPONIBILIDAD PARA EVALUAR INFORMES DE CONVALIDACION DE CREDITOS ECTS
¿Es una prioridad para el supervisor que el estudiante valide los créditos?
Availability to evaluate ECTS credit validation reports
Is it a priority for the supervisor that the student validates ECTS credits?

yes

2. DESCRIPCION DEL PROYECTO Project description

FECHAS ORIENTATIVAS DE REALIZACION DEL PROYECTO
Wished/approximate dates for the mobility period

To be discussed

FLEXIBILIDAD DE FECHAS
Flexibility in dates

■ SI yes
☐ NO

TÍTULO DEL PROYECTO Project title

Design of a simulated moving bed for the recovery of unconverted ammonia from an ammonia cracking system for the production of hydrogen

NUMERO DE HORAS DE TRABAJO POR SEMANA Number of working hours per week

35

PROGRAMA Detailed programme of the traineeship

Hydrogen obtained from cracking of green ammonia (breaking up NH3 into the molecular constituents e.g. H2 and N2) represents a promising solution to the challenges related to hydrogen storage, transportation and production over large distances for future hydrogen energy applications. However, in order to be used for energy applications, high purity H2 is needed and the removal of residual NH3 is necessary. In this project we propose to design and assemble a simulated moving bed process for hydrogen purification. The aim is to design a continuous hydrogen purification process based on adsorption of NH3 downstream of the cracking processes and to lower in this way the NH3 concentration below 100 ppb. The first step is then to design the simulated moving bed (SMB), using an engineering reactor model (coupled heat & mass balance) describing the adsorption and desorption of ammonia on zeolites. The trainee will then do some experiments using a tubular reactor to acquire the numerical values and parameters appearing in the reactor model (effective dispersion, ammonia loading, etc.): Using the breakthrough curves and the regenerating time, the position of the inlets/outlets and valve switching time will be optimized to mimic solid movements in the bed. The desorption of ammonia (regeneration) will be done by passing hot gas through the saturated bed allowing to characterize the regeneration kinetics. If time allows, the trainee will contribute in the definite design of the SMB and its construction (parallel beds with switching valve system and thermal swing using induction heating).

CONOCIMIENTOS, HABILIDADES Y COMPETENCIAS QUE HAN DE ADQUIRIR LOS ESTUDIANTES
Knowledge, skills and competences to be acquired by the end of the traineeship

The trainee will gain invaluable knowledge of experimental tools used in reactor design and characterization (online quadrupole mass spectrometer for gas concentration analysis, tracer studies for hydrodynamic characterization, etc.), including complex reactor simulation using state-of-the-art kinetic models. As important, the trainee must be able to communicate effectively his/her results. All in all, the main expected learning outcomes are:
- Perform characterization and basic modelling of chemical reactors by application of his/her knowledge on chemical engineering reaction.
- Communicate and discuss proposals and conclusions in multilingual forums and weekly follow-up meetings, specialized and non-specialized, in a clear and unambiguous way in English.
- Prepare a manuscript summarizing his/her work in English.
- Introduction to the field of scientific research, favoring independence and creativity

MONITORIZACION Monitoring plan

The trainee will work under the supervision of Prof Patrice Perreault, and will work in collaboration with 1 senior PhD students and/or postdoc working on this project. Prof Perreault and/or the PhD students/postdoc will train the trainee on the design of fluidized bed reactors, as well as how to include the joule effect. For the first month, the trainee will be in close contact with Prof Perreault, 1-2 days per week. For the remaining period, the trainee will be supervised in the form of a weekly meeting (where he/she will have to present the project advancement), and will spend half a day per week for training.

EVALUACIÓN Evaluation plan

The work will be evaluated during the weekly follow-up meetings. The researchers present their achievements, discuss problems & challenges, as well as proposing a planning for the week to come. In this way, they are confronted to their actual versus planned progress, and to propose corrective measures. If the corrective measures are considered insufficient, we as a group explore other measures (including increasing the workforce involved in a project). These meetings are a platform to exchange and challenge scientific ideas, and for problem solving. The trainee will also be required to summarize her/his ideas in the form of a manuscript.

ESPECIFICACIONES ADICIONALES EN LA INSTITUCIÓN DE ACOGIDA
Additional specifications of the host institution

OTRA INFORMACIÓN RELEVANTE Other relevant information

The trainee will contribute to the advancement of a currently running project, so the host applicant directly benefits by getting help to the delivery of the work packages of the project. The host applicant also benefit by broadening his researchers network, both with the individual students and the sending institution. The trainee will benefit by working in a new state-of-the-art laboratory, fully equipped with advanced gas analysis (RGA GC, quadrupole mass analyzer), and reactor diagnosis tools (pressure fluctuations, particle image velocimetry, etc.). The trainee will develop his autonomy: as part of this trainee, the trainee will not be asked to plainly do repetitive measurements, but either scientificallyt contribute to the research project, just like the PhD students and postdoc in the group (but of course under supervision). The trainee will be requested to prepare a manuscript, which should be submitted to a Q1 journal in maximum one year timeframe.

3. PERFIL Y REQUISITOS DEL ESTUDIANTE Student profile and requeriments

AREA/S DE ESTUDIO Research area/s

Chemical Engineering

NIVEL DE ESTUDIO Level of studies

Level of studies: 3rd years in process or completed.

REQUISITOS PREVIOS DE CONOCIMIENTOS TECNICOS O EXPERIENCIA
Student required expertise and technical knowledge:

Reactor design and Heat transfer courses completed.

IDIOMA Y NIVEL MINIMO RECOMENDADO PARA REALIZAR LAS PRACTICAS
Language and minimum level recommended for internships

English B1 (the supervisor speaks Spanish)

REQUISITOS ADICIONALES DE LA INSTITUCION DE ACOGIDA
Additional requirements set by the host institution

None