

## CONVOCATORIA DE PRÁCTICAS INTERNACIONALES / CALL FOR INTERNATIONAL INTERNSHIP

### CONVENIO CEBE 2021 / CEBE 2021 AGREEMENT

#### I. HOST APPLICANT INFORMATION

*This person is responsible for signing the Learning Agreement, amending it if needed, supervising the trainee during the traineeship and signing the Traineeship Certificate.*

Name	Patrice Perreault							
Position	Associate Professor							
Contact (e-mail, phone)								
Department/Faculty. Institution	Institute of Environment & Sustainable Development (IMDO), Faculty of Science University of Antwerp							
Organization Type (see annex I)	EPLUS-EDU-HEI							
Public body	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO	Public body	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO	Public body	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
Address; website	Campus Groenenborger – building V.612, Gronenborgerlaan 171 – 2020 Antwerpen, Belgium; <a href="https://www.uantwerpen.be/">https://www.uantwerpen.be/</a>							

#### II. PROJECT DESCRIPTION

*Description of the project that will be done by the student-trainee at the host institution.*

Wished period for mobility <sup>(1)</sup> : from (day/month/year) 01/04/2021 to (day/month/year) 01/06/2021
1. Project title: Hydrogen release from Liquid Organic Hydrogen Carriers (LOHC) in a centrifugal and induction heated reactor
2. Number of working hours per week: 35

### 3. Detailed programme of the traineeship <sup>(2)</sup> (max. 300 words):

In state-of-the-art reactors used for the dehydrogenation of LOHC, spherical catalyst particles are used in partly filled multitubular packed bed reactors. However, due to the viscosity of the LOHC and the presence of particles, part of the considerable volumes of H<sub>2</sub> generated (650 ml per ml of LOHC) tend to remain in the reactor, thus limiting the required contact between the LOHC and the catalyst particles, resulting in an inefficient reactor. For this reason, we built a centrifugal dehydrogenation reactor where the heat is supplied through induction directly at the site of the chemical reaction: a rotating basket containing SS beads and a commercial catalyst.

In this project, the trainee will characterize 1) the hydrodynamics of the swirling reactor prototype with a combination of experimental tools (residence time distribution, pressure drop determination, etc.) and digital image processing. This first set of experiments will be performed at ambient temperature using water, 2) heat transfer by monitoring the temperature profiles of both the catalyst particles (IR probe) and the liquid (first water, followed by dibenzyl toluene (DBT, i.e. the LOHC), 3) whether it is possible to concentrate H<sub>2</sub>-lean and H<sub>2</sub>-rich DBT by “mild” centrifugation (rotation of the spinning basket) by simple colorimetry (H<sub>2</sub>-rich and -lean have different colours), 4) the optimal parameters (liquid flowrate, electrical power of the induction heating, spinning basket rotational velocity, etc.) for optimal dehydrogenation rates (volumetric measurements of the H<sub>2</sub> produced) and H<sub>2</sub> purity (monitored by mass spectrometry).

### 4. Knowledge, skills and competences to be acquired by the end of the traineeship (expected Learning Outcomes)(max 100 words):

The trainee will gain invaluable knowledge of state-of-the-art experimental tools used in reactor characterization, as well as innovative digital image processing tools. 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, specialized and non-specialized, in a clear and unambiguous way in English.

### 5. Monitoring plan (max 100 words):

The trainee will work under the supervision of Prof Patrice Perreault, and will work in collaboration with 1 PhD students working on this project. Prof Perreault and/or the PhD students will train the trainee on the use of digital image processing, and basic experimental reactor characterization tools. The trainee will be supervised in the form of a weekly meeting (where he/she will have to present the project advancement in the form of a presentation in front of the other PhD students).

### 6. Evaluation plan (max 100 words):

The progress of the trainee will be evaluated on the basis of his/her capacity to:

- conduct a thorough literature review on the subject of experimental characterization tools and digital image processing.
- integrate the findings of this review to propose original and innovative measurement techniques.
- perform rigorous experimental characterization, including statistical analysis.
- address scientific problems and overcome challenges

Also, if possible, the work carried out by the trainee may be presented as part of his/her Master's Thesis. Also, the work carried within this project will end up in at least one publication in a high impact factor chemical engineering journal.

### 7.a. Impacts and benefits of the traineeship to the host applicant (max 100 words):

The host applicant will benefit from the work of the trainee in various aspects: i) to deliver the work required as part of the funded project (characterization of state-of-the-art reactors), ii) to formalize the experimental techniques and data analysis for the hydrodynamic characterization of chemical reactors, including the associated documentation to ensure a long term research success and smooth transition of incoming students, and iii) to formalize a strong collaboration with the Universidad Castilla-La Mancha / UAM.

### 7.b. Impacts and benefits of the traineeship to the trainee (max 100 words):

The trainee will benefit from the acquired knowledge in the field of hydrodynamic characterization of reactors, including innovative digital image processing tools. In addition, the trainee will learn to devise diagnosis tool and criteria to characterize the operation of state-of-the-art reactors, including faulty operations. The knowledge acquired by the trainee is applicable to various types of chemical reactors, not limited to that of the current project.

## III. STUDENT PROFILE AND REQUIREMENTS

*This section refers to specific knowledge or expertise that the student/trainee must have in order to proceed successfully with the proposed project.*

<b>8. Research Area (see annex II): Chemical Engineering</b>	
<b>9. Is the host applicant / scientific supervisor willing to evaluate the project performance so that the student could validate the traineeship as ECTS credits (3):</b>	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

<p><b>10. Student required expertise and technical knowledge:</b> For this project, we need <u>2 or 3 students</u>. Basic knowledge of Matlab, and chemical reaction engineering concepts (residence time distribution, space and residence time, etc.).</p>		
<p><b>11. Level of studies:</b> Currently at the master or PhD level</p>		
<p><b>12. Language:</b> English and Spanish (the host professor speaks fluently Latin-American Spanish, French, English and intermediate Dutch)</p>		
<p>(4) The level of <b>language competence</b> in _____ (indicate here the main language of work that the trainee already has or agrees to acquire by the start of the mobility period is: A1 <input type="checkbox"/> A2 <input type="checkbox"/> B1 <input checked="" type="checkbox"/> B2 <input type="checkbox"/> C1 <input type="checkbox"/> C2 <input type="checkbox"/> Native speaker <input type="checkbox"/></p>		
<p><b>13. Does the host institution require any other language besides the language of work?</b></p>	<p><input type="checkbox"/> YES    <input checked="" type="checkbox"/> NO</p>	<p><b>Which one?:</b></p>
<p><b>14. Does the host institution require any further paperwork done or any other relevant information to host a student/trainee (under the condition of this programme)</b></p>	<p><input type="checkbox"/> YES    <input checked="" type="checkbox"/> NO</p>	<p><b>14. A</b> If YES, please detail:</p>

#### IV. Consent to publish Traineeship Data.

I agree that my name, title of the project, its duration and the name of the Receiving Institution / Enterprise can be published on the CEBE website as awarded supervisor of the Traineeship Programme 2020.



- (1) a) Related to UAM: A minimum of 2 months and up to 4 months (only the first 3 are funded). The planned period in this call should be between 1st of June 2020 and 30th of December of 2021. After the matching of host candidates with students and by mutual agreement between the two parties, the exact dates can be changed and the total stay could be prolonged up to 6 months; b) Related to UCLM: A minimum of 2 months and up to 4 months (all 4 months are funded). The estimated start date of the internship is 1st July and can be extended up to a total of 12 months.
- (2) Consider that this must be read by the selection committee but also by the students, who will apply to the project.
- (3) If NO, only students who will not validate the project as ECTS credits will be assigned for matching with this applicant. The application to validate the project as ECTS credits will come exclusively from the student.
- (4) Level of language competence: a description of the European Language Levels (CEFR) is available at: <https://europass.cedefop.europa.eu/en/resources/european-language-levels-cefr>

#### Annex I: List of Organisation Types

CODE	Organisation type
------	-------------------

EPLUS-EDU-HEI	Higher education institution (tertiary level)
EPLUS-EDU-GEN-PRE	School/Institute/Educational centre – General education (pre-primary level)
EPLUS-EDU-GEN-PRI	School/Institute/Educational centre – General education (primary level)
EPLUS-EDU-GEN-SEC	School/Institute/Educational centre – General education (secondary level)
EPLUS-EDU-VOC-SEC	School/Institute/Educational centre – Vocational Training (secondary level)
EPLUS-EDU-VOC-TER	School/Institute/Educational centre – Vocational Training (tertiary level)
EPLUS-EDU-ADULT	School/Institute/Educational centre – Adult education
EPLUS-BODY-PUB-NAT	National Public body
EPLUS-BODY-PUB-REG	Regional Public body
EPLUS-BODY-PUB-LOC	Local Public body
EPLUS-ENT-SME	Small and medium sized enterprise
EPLUS-ENT-LARGE	Large enterprise
EPLUS-NGO	Non-governmental organisation
EPLUS-FOUND	Foundation
EPLUS-SOCIAL	Social partner or other representative of working life
EPLUS-RES	Research Institute/Centre
EPLUS-YOUTH-COUNCIL	National Youth Council
EPLUS-ENGO	European NGO
EPLUS-NET-EU	EU-wide network
EPLUS-YOUTH-GROUP	Group of young people active in youth work
EPLUS-EURO-GROUP-COOP	European grouping of territorial cooperation
EPLUS-BODY-ACCRED	Accreditation, certification or qualification body
EPLUS-BODY-CONS	Counselling body
EPLUS-INTER	International organisation under public law
EPLUS-SPORT-PARTIAL	Organisation representing the sport sector
EPLUS-SPORT-FED	Sport federation
EPLUS-SPORT-LEAGUE	Sport league
EPLUS-SPORT-CLUB	Sport club

## Annex II: Research Areas

Area of knowledge	University
Agricultural and agri-food engineering	Universidad Castilla La Mancha
Aerospace engineering	Universidad Castilla La mancha
Biochemistry	Universidad Autónoma de Madrid, Universidad Castilla La mancha
Biology	Universidad Autónoma de Madrid
Biomedical engineering	Universidad Castilla La Mancha
Chemical Engineering	Universidad Autónoma de Madrid, Universidad Castilla La mancha
Chemistry	Universidad Autónoma de Madrid, Universidad Castilla La mancha
Computer Engineering	Universidad Autónoma de Madrid, Universidad Castilla La mancha
Computer Engineering and Mathematics	Universidad Autónoma de Madrid
Electrical Engineering	Universidad Castilla La mancha
Environmental Sciences	Universidad Autónoma de Madrid, Universidad Castilla La mancha
Food Science and Technology	Universidad Autónoma de Madrid, Universidad Castilla La mancha
Forestry and environmental engineering	Universidad Castilla La mancha
Human nutrition and dietetics	Universidad Autónoma de Madrid
Industrial and automatic electronics engineering	Universidad Castilla La mancha
Mathematics	Universidad Autónoma de Madrid
Mechanical engineering	Universidad Castilla La mancha
Medicine	Universidad Castilla La mancha
Nursing	Universidad Castilla La mancha
Pharmacy	Universidad Castilla La mancha
Physics	Universidad Autónoma de Madrid
Physiotherapy	Universidad Castilla La mancha