



CEAD Circular Engineering Across Disciplines



International summer school for engineering students

2023 Edition – Turning waste into resources

Transitioning to a circular economy is needed to ensure a healthy planet and a strong economy for current and future generations. Engineers play a key role in this shift. With their knowledge and skills, these problem-solvers can assess and optimise the entire life cycle of products, services, and processes with innovative solutions. In this 2023 edition of the international summer school CEAD, we focus on reusing materials in various fields. You will be introduced to the general principles of the circular economy. You gain insight into the most recent research in recycling processes, process intensification as leverage for energy reduction and higher efficiency, intelligent smart packaging, and reuse of building materials. Lectures, interactive workshops, and lab activities in several inspiring research locations will boost your knowledge and know-how about the topic. International and interdisciplinary teamwork enhances your communication skills and makes you aware of the global importance of circular engineering. Company visits show how circular solutions are already being embraced today. University engineering students of bachelor or master level can apply. The selection is based on your application letter stating your motivation and your academic progress

*The training week will take place from **23-28 April 2023**, on campus, followed by a virtual part to be completed at the latest **5 May 2023**.*

The application deadline is 30 November 2022. All applicants will be informed about their selection by the end of December 2022.

[APPLY here](#)

Academic coordination

Prof. dr. Bart Vermang (UHasselt)

Prof. dr. Ir. Eric Demeester (KU Leuven)

Administrative coordination and contact

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Organisation

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BELGIUM

With the support of the faculty of Business Economics of UHasselt and Eureka-Pro.

Programme of the on-site part

**International summer school - CEAD - Circular engineering across disciplines
2023 Edition - Turning waste into resources
on-site programme**

Sunday 23-4-2023 8 a.m.	WELCOME DRINK at the hotel with group allocation (mandatory for all participants)			
Monday 24-4-2023	Tuesday 25-4-2023	Wednesday 26-4-2023	Thursday 27-4-2023	Friday 28/04/2023
09.30-10.00 h SICK-OFF				
10.00-13.00 h Risk and Race (circular economy game VITO) by prof. Tom Kappers	09.30-13.00 h WORKSHOP 1 Research a sustainable Bham-ton battery industry by prof. Mono Safari	09.30-13.00 h WORKSHOP 2 Recycling plastic waste: robotic sorting, material selection and product design by prof. Karel Kellens, prof. Eric Driessens and prof. Anton Grintburg	09.30-13.00 h WORKSHOP 3 Reuse of material in the construction sector by prof. Harve Degele	09.30-13 h EVALUATION - FINAL PRESENTATION OF WORK
13.00-14.00 h LUNCH BREAK lunch offered by the organisation	13.00-14.00 h LUNCH BREAK	13.00-14.00 h LUNCH BREAK lunch offered by the organisation	13.00-14.00 h LUNCH BREAK	13.00-14.00 h LUNCH BREAK lunch offered by the organisation
14.00-15.00 h Risk&Race debriefing + general principles of circular economy by prof. Tom Kappers		14.00-17.30 h WORKSHOP 3 New standards using sound and sustainable clouds for greener chemical processes by prof. Leon Brecken and prof. Wim n Eric Ledwith		14.00-15.00 h GENERAL CLOSE-OUT Evaluation of the week by the participants presentation of the research groups and study programmes in engineering of UHasselt and KU Leuven
BREAK	14.00-17.30 h Visit to the incubator Greenville in Heusden	14.00-17.30 h WORKSHOP 4 From recycled paper to screen-printed smart packaging applications by prof. Heke Buisson, prof. Wim Delfosse and prof. Roos Peeters simultaneous sessions		
15.15-16.00 h Pick-up of preloved bicycles for the participants	17.30-19.00 h free time		extra time for self-study - preparation evaluation	
	19.00- ... group dinner			

[Clikck for the PDF](#)

Introduction in circular economy | Risk&Race game

by prof. Tom Kuppens

The Risk&Race game is a tabletop board game, designed to induce an entrepreneurial mindset and introduce players to entrepreneurial decision-making and circular economy business models. And of course, it is also fun and challenging, just as a game should be!

During the game players are entrepreneurs. They buy resources, manage their employees, and produce and sell products on the market. External factors affect market demand, price, availability of resources, and legislative requirements. Players have opportunities to invest in infrastructure, technological innovation, human resources, and business strategies to strengthen their company and remain profitable.

Workshop 1 | Towards a sustainable lithium-ion battery industry

by prof. Momo Safari

The market for lithium-ion batteries experiences a rapid expansion in the transport sector given the global efforts to decrease greenhouse gas emissions and improve the air quality in urban areas. However, the growing number of electric vehicles calls for attention to the sustainability aspects of battery manufacturing and waste management at the end of life. To put this into perspective, electrification of only 2% of the current global car fleet would represent a line of cars that could stretch around the Earth! In this workshop, we learn about the current practices in the manufacturing and recycling of lithium-ion batteries and identify the current technical and economic challenges and the possible strategies for future progress.

Workshop 2 | Recycling plastic waste: robotic sorting, material selection and product design

by prof. Karel Kellens, prof. Eric Demeester and prof. Anton Ginzburg

In this workshop, you will study and explore important aspects of (plastic) waste recycling processes. On the one hand, we will focus on the automated, vision-based sorting of waste, on the other hand, we will evaluate material selection and product design when using recycled plastic waste.

Firstly, the automated sorting part starts with an introduction to the different components of a robotic sorting unit: the sensing part (e.g. camera, illumination), the thinking part (waste recognition, robotized waste grasping), and the action-taking part (robots, grippers, conveyor belts). Next, hands-on experience will be gained on several of these automation components. You will be challenged to critically reflect on the feasibility of automated (plastic) waste recycling, including an analysis of technical challenges, (country-specific) opportunities, strengths, and weaknesses.

Secondly, material selection and product design are evaluated for existing products and processes to achieve a recycle-friendly product. Particular attention is paid to means to ensure that the recycled material loses as little as possible of its (mechanical) properties.

You are challenged to make your suggestions on design rules and testing for performance comparison of the most important material properties.

Workshop 3 | New standards: using sound and manmade clouds for greener chemical processes

by prof. Leen Braeken and prof. Mumin Enis Leblebici

In this workshop, students are introduced to the basic principles of process intensification and its potential to intensify chemical processes by energy reduction and increased performance. Students gain insights into new micro-structured reactors and the integration of sound and light waves in chemical reactors. Case studies performed in collaboration with the industry are presented focusing on CO₂ capture and sonocrystallization of active pharmaceutical compounds. Finally, hands-on sessions offer the opportunity to experience and quantify the effect of sound and light in these applications and get familiar with reactor characterisation and control.

Workshop 4 | From recycled paper to screen-printed smart packaging applications

by prof. Mieke Buntinx, prof. Wim Deferme and prof. Roos Peeters

Intelligent smart packaging is an emerging technology, which improves the standard communication function of packaging. Printed electronics on recycled paper could offer cost-efficient and sustainable solutions. However, though paper is an interesting and recyclable material, printing on this substrate is challenging as the ink conductivity is highly influenced by the paper's properties. In this workshop, the student will investigate different paper characteristics in the labs of Materials and Packaging Research and Services (MPR&S) and subsequently screen print conductive inks on these substrates in the labs of Functional Materials Engineering (FME). This joint workshop aims to get an insight into the effect of the paper substrate and the used ink on the final sheet resistance of the screen-printed samples. This data is key to defining potential applications of printed electronics on recycled paper as smart packaging.

Workshop 5 | Reuse of material in the construction sector

by prof. Hervé Degée

The circular economy aims at closing the materials cycle and moving away from a linear economy in which construction materials are labelled as waste at the end of their lifespan. This transition is an essential and urgent step for the construction sector. The sector is indeed one of the largest materials and energy consumers and is also an important source of greenhouse gas emissions. 50% of natural resources find their way to this sector while at the same time, 33% of the entire waste production is generated here. Circular construction is a broad concept that encompasses different aspects at different scales, from the choice of materials in the initial design to the global scale of the

construction project. This session will give a general introduction to circular concepts in the construction sector focusing on the selection of materials and relying on the analysis of real-life cases.

Visit to Greenville

Greenville is the incubator for cleantech and circular economy in the province of Limburg. It is the hub for businesses that are going for sustainable impact: the ideal playground for ambitious entrepreneurs who want to work in an environment that inspires innovation.

Language of instruction

English

Credits

Equivalent to 3 ECTS

Blended didactic approach

On campus | 23-28 April 2023

- Lectures, interactive workshops, and lab activities
- Company visits
- Teamwork and social activities
- Oral presentation of the teamwork

Virtual | 29 April-5 May 2023

- Online team meeting to prepare the written report
- Written report on the teamwork
- Quality survey

Learning outcomes

Participants gain insight into and enhance their know-how in:

- the general principles of a circular economy.
- the sorting and reusing of materials in durable energy, packaging, and construction.
- the green optimisation in processes.

Participants boost:

- their intercultural communication skills through international multidisciplinary teamwork.

- their awareness of the global necessity and civic interest of circular engineering for the circular economy through critical reflection.

Evaluation

- Oral presentation and report of the group work (only for participants in the complete on-site and virtual programme)
- Attendance at all activities is mandatory

Validation

Certificate of participation – 3 ECTS (approx. 80-90 hours of total study load)

Application and selection

- [Application form with motivation and academic progress](#)
- Deadline: 30 November 2022
- You can apply for a separate session or the complete on-site and virtual programme
- Applicants for the complete programme will be given priority
- All applicants will be informed about their selection by the end of December 2022
- Selection will be based on your motivation, study progress, study field, and gender to ensure interdisciplinarity and diversity of committed student teams with a general background in engineering.

Registration fee and budget

- No registration fee
- Welcome drink and group dinner offered by the organisation
- Accommodation offered by the organization
- Travel and visa costs, transport, and meals at your own expense

Accommodation

Shared rooms will be booked for you in Hasselt or Diepenbeek.

Travel info

Please DO NOT book your flight before you get official confirmation of acceptance.

How to get to Hasselt when flying in.

Brussels airport (Zaventem)

When you arrive at Brussels Airport, you can travel to Hasselt by train. Depending on the time of day there is a direct railway connection between Brussels North Station and Hasselt. Shorter will be to take the train from Brussels Airport station directly to Leuven. And from there you continue to Hasselt.

Check the website of the Belgian railways to find all the up-to-date information you will need (passenger traffic services, timetables, and prices).

<http://www.b-rail.be> (link is external)

Charleroi airport (Brussels-South)

Every 30 minutes a shuttle coach leaves the airport to drive to the main Brussels railway station (Brussels Midi). There you can take a (direct) train to Hasselt.

<http://www.b-rail.be> (link is external)

How to get to the university campus of Diepenbeek.

When arriving by car

You enter the following address into your GPS: Agoralaan, Diepenbeek, Belgium.

[Campus map](#)

When arriving by local bus

There is a bus terminal in front of the railway station of Hasselt. From there you take the bus to the university campus of Diepenbeek. The bus stop is Agoralaan, Diepenbeek.

More information: <https://www.delijn.be/en/>



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