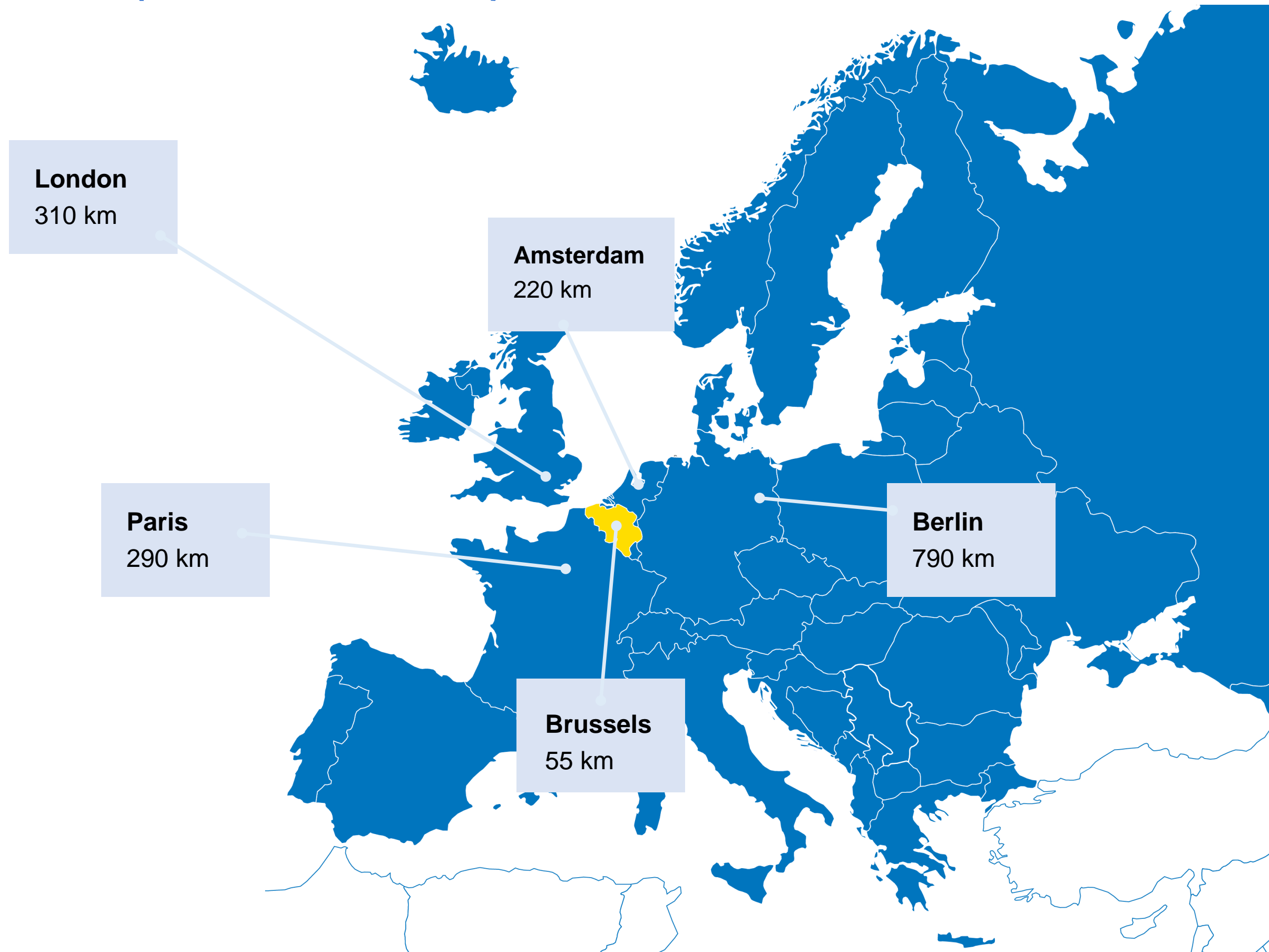




© UGent, Jonas Vandersteele en Yentl Vandendriessche

GHENT (BELGIUM)



GHENT (BELGIUM)

A genuine student city with
+70,000 students



EDUCATION

Total number of students

45,979

International students

13%

(NUMBERS: OCT. 2019)



RESEARCHERS AT GHENT UNIVERSITY

Total number of researchers



8,220

Professorial researchers

1,433

Postdoctoral researchers

1,462

Predoctoral researchers

5,325

ACADEMIC
PROGRESS
MODEL

QUALITY
RECRUITMENT

LEADERSHIP &
TRUST

TALENT
DEVELOPMENT
& TRAINING

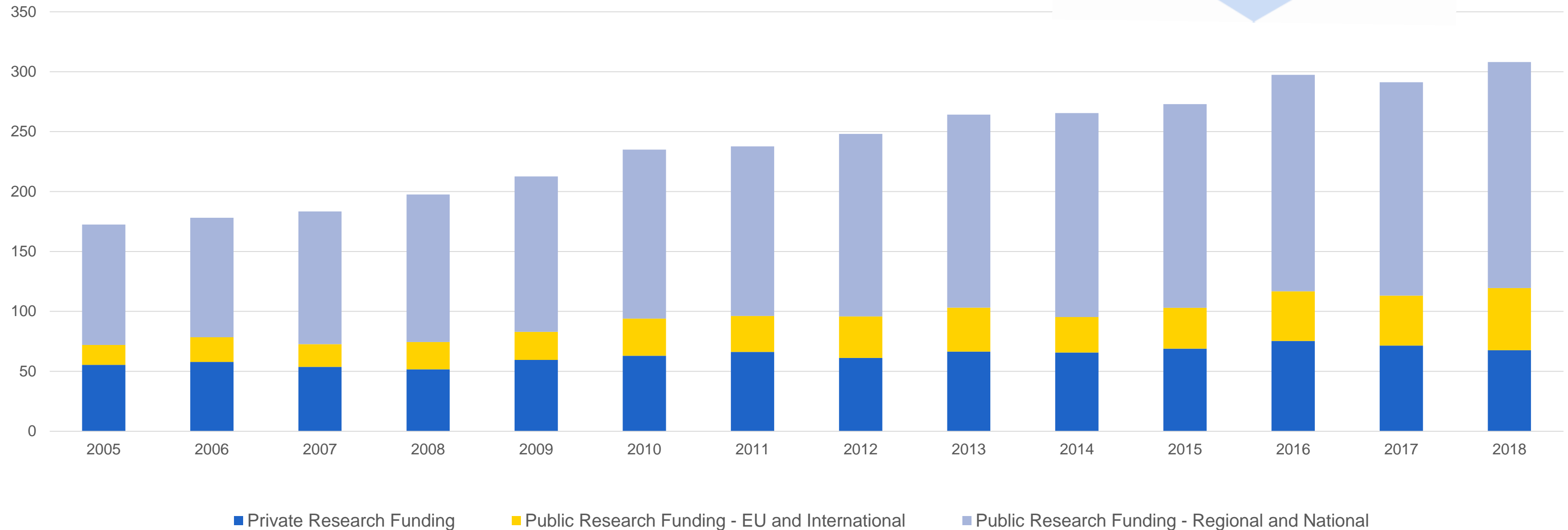
RESEARCH INTEGRITY

(NUMBERS: OCT. 2019)

INPUT

Research expenditures 2018: € 308 million

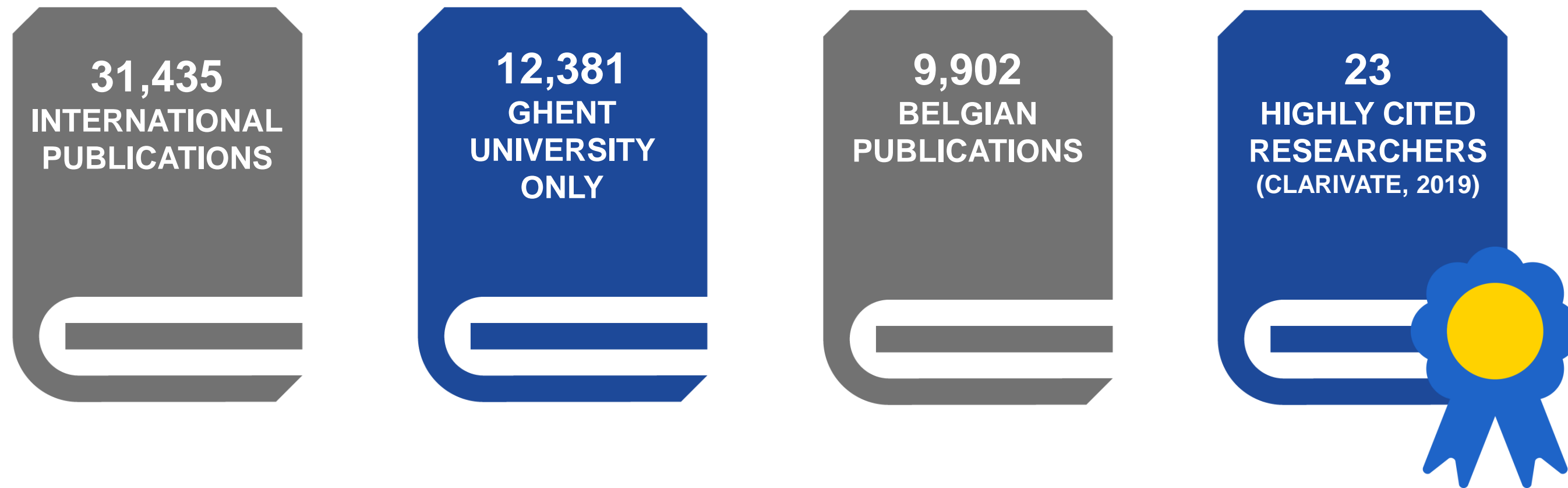
66 ERC projects



(NUMBERS: JUNE 2019)

OUTPUT

Publications 2008 - 2018



Total number of publications at Ghent University

53,718

STUDENT MOBILITY

2,052

Ghent University students abroad yearly
[23% of all graduating students with experience abroad]

6,012

Foreign students at Ghent University
[including 1,542 exchange students and
393 at GUGC]

European pioneer in the digitisation
of student mobility processes



RANKINGS

Academic Ranking of World Universities 2020 (Shanghai ranking)

Worldwide: 66

National: 1

Times Higher Education Ranking

Worldwide: 143

National: 3

(NUMBERS: 2020)

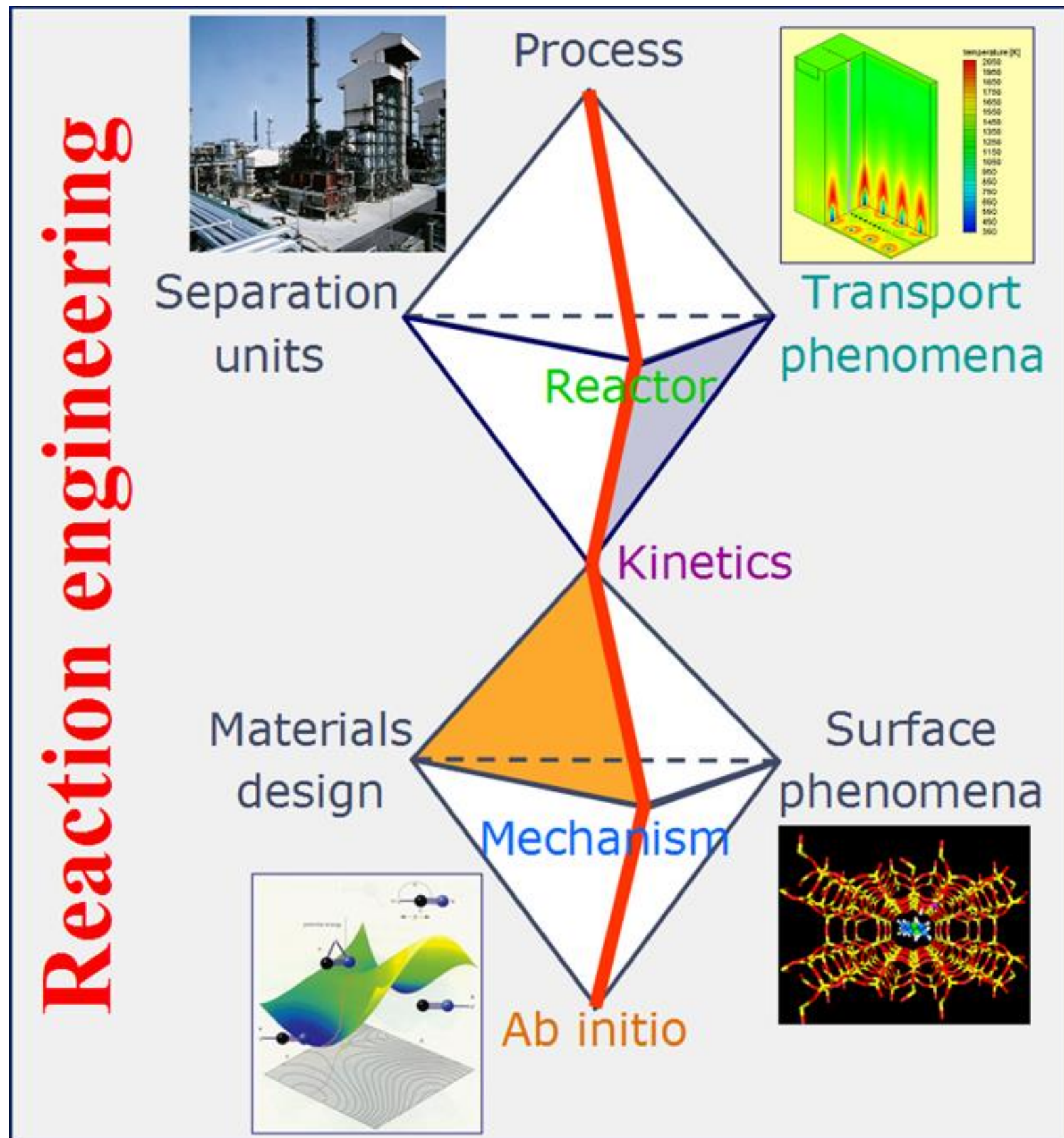


LABORATORY FOR CHEMICAL TECHNOLOGY

Executive committee: Mark Saeys, Joris W. Thybaut & Kevin M. Van Geem (chair)

Board: Geraldine J. Heynderickx, Marie-Françoise Reyniers, Mark Saeys, Joris W. Thybaut, Kevin M. Van Geem, Georgios Stefanidis, Dagmar R. D'hooge, Vladimir V. Galvita, Maarten K. Sabbe, Paul Van Steenberge

From molecule to process



Permanent staff members (11)

Prof. G.J. Heynderickx

Prof. G.B. Marin

Prof. M.F. Reyniers

Prof. M. Saeys

Prof. J.W. Thybaut

Prof. K.M. Van Geem

Prof. D.R. D'hooge

Prof. V.V. Galvita

Prof. M.K. Sabbe

Prof. Stefanidis

Prof. Vansteenberge



Guest lecturers or professor (4)

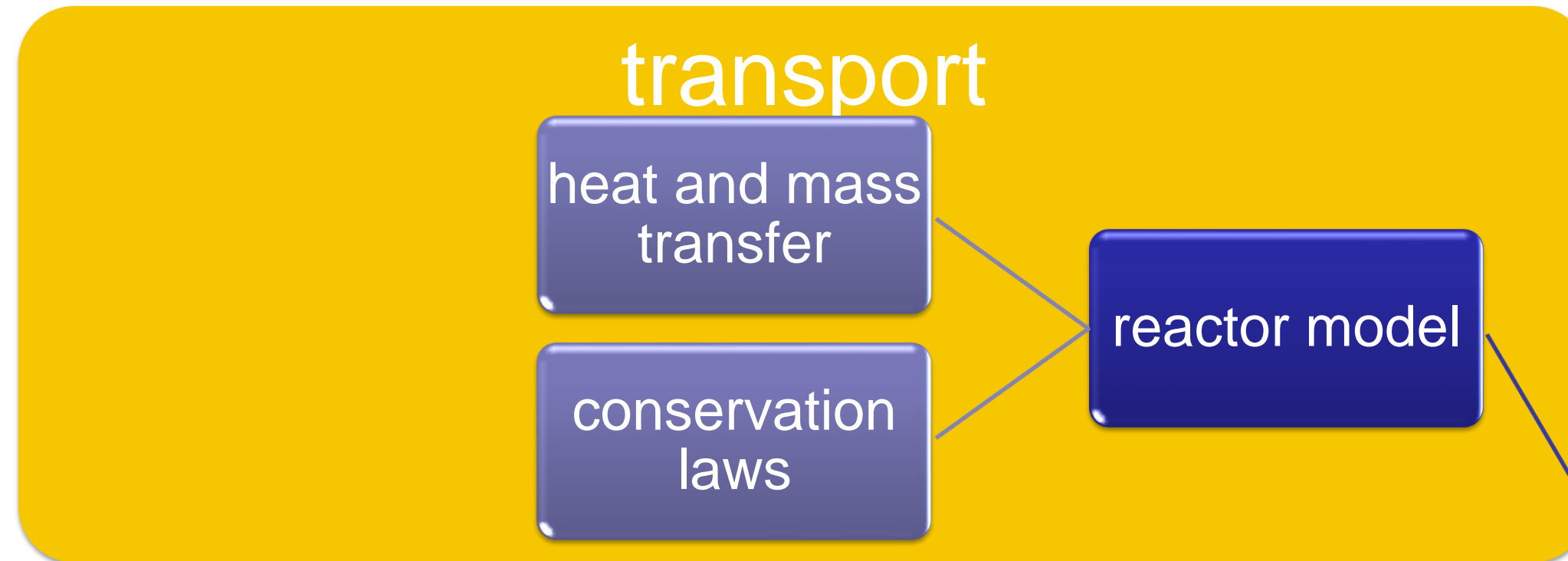
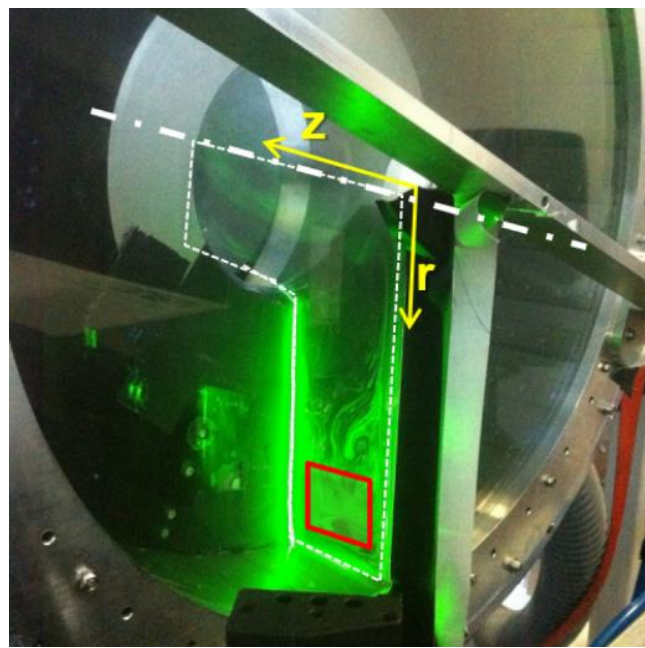
Senior and visiting scientists (4)

Postdocs (16)

PhD students (62)

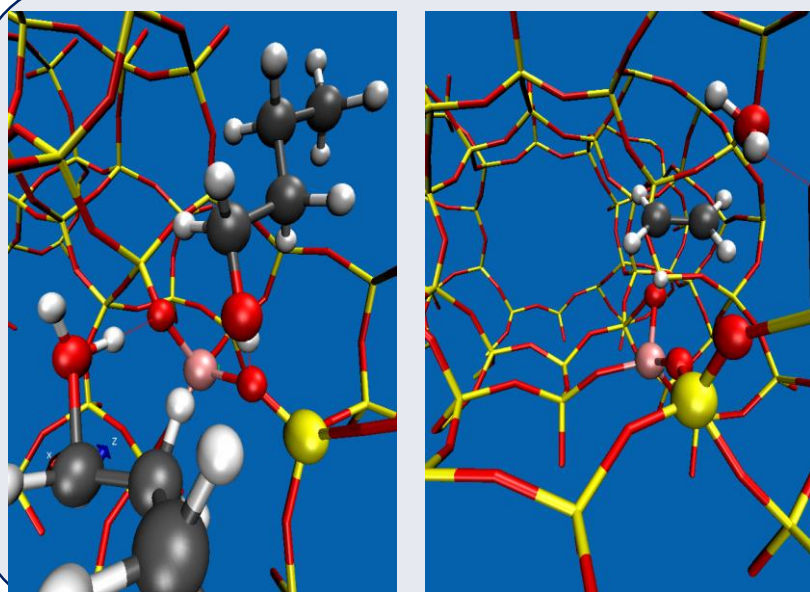
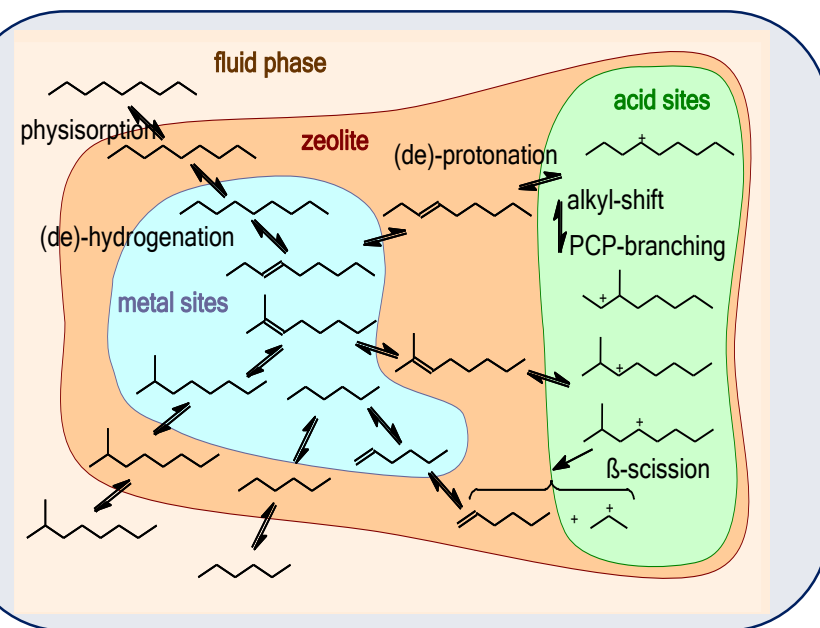
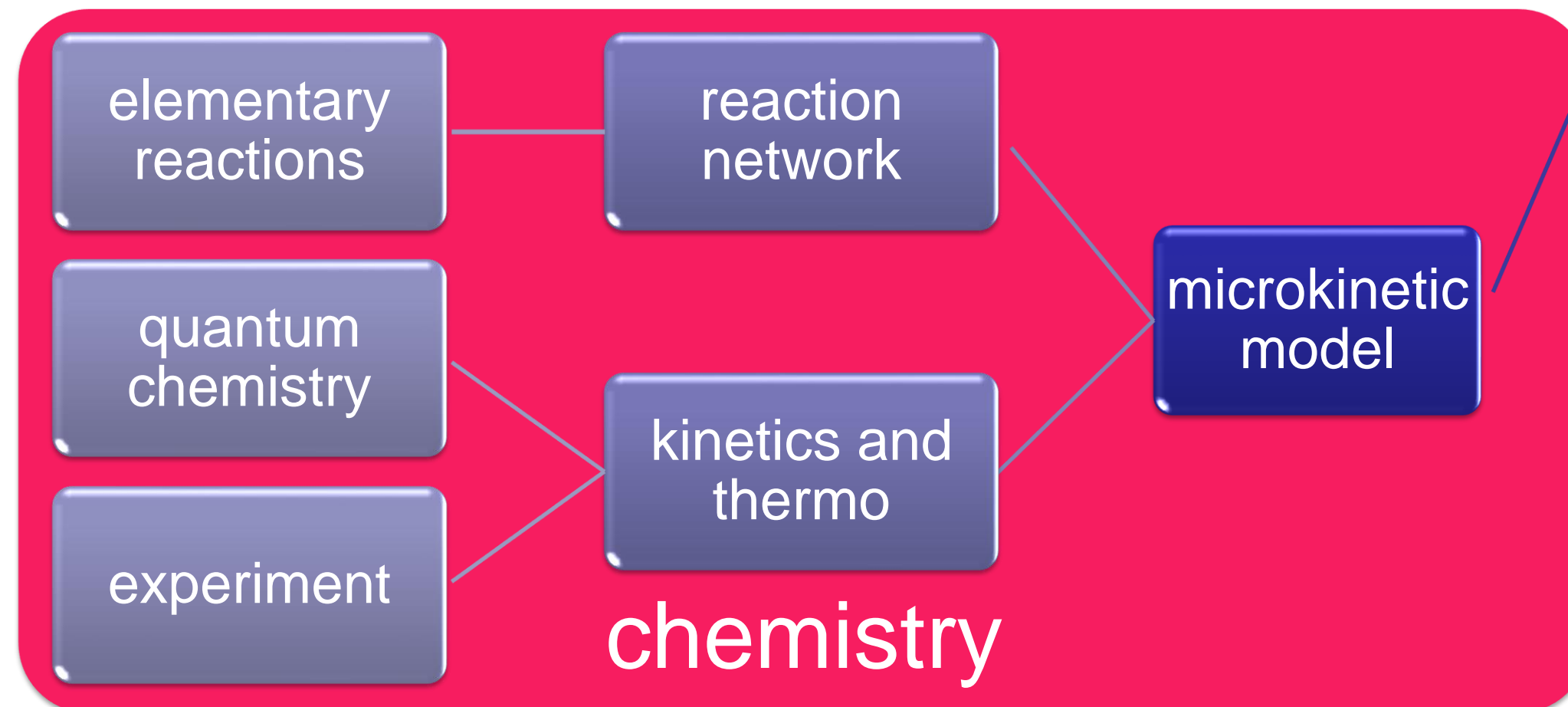
Technical staff and administration (11)

From molecule to process



process

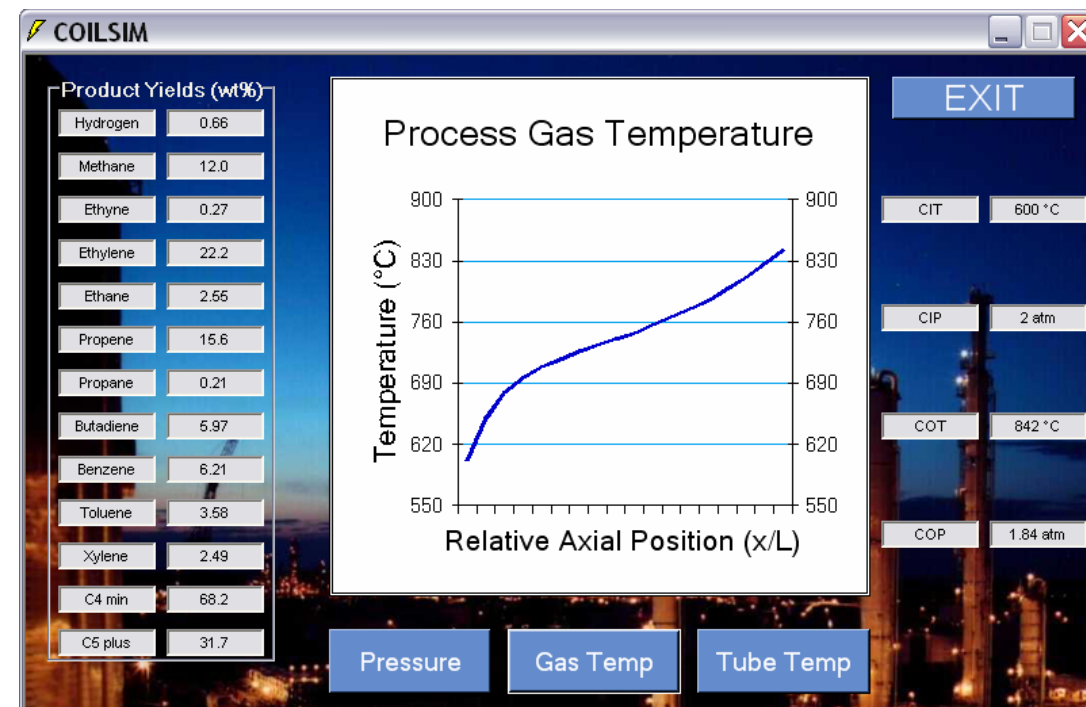
dimensions
heat duty
temp. field
conc. field
rates
yields



LCT infrastructure and assets

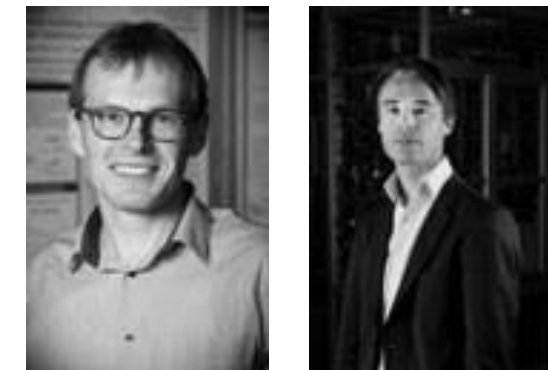
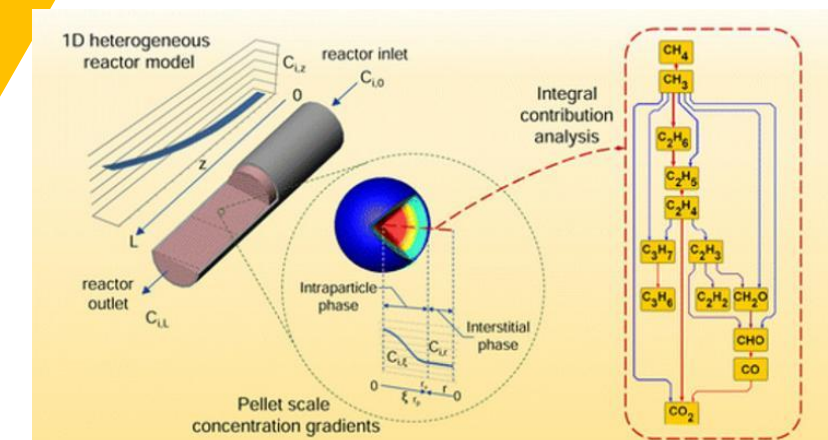
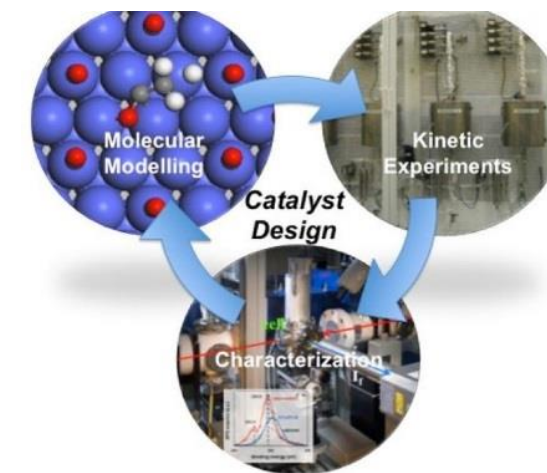
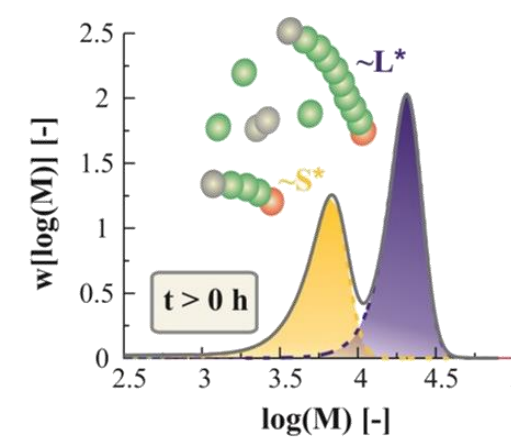
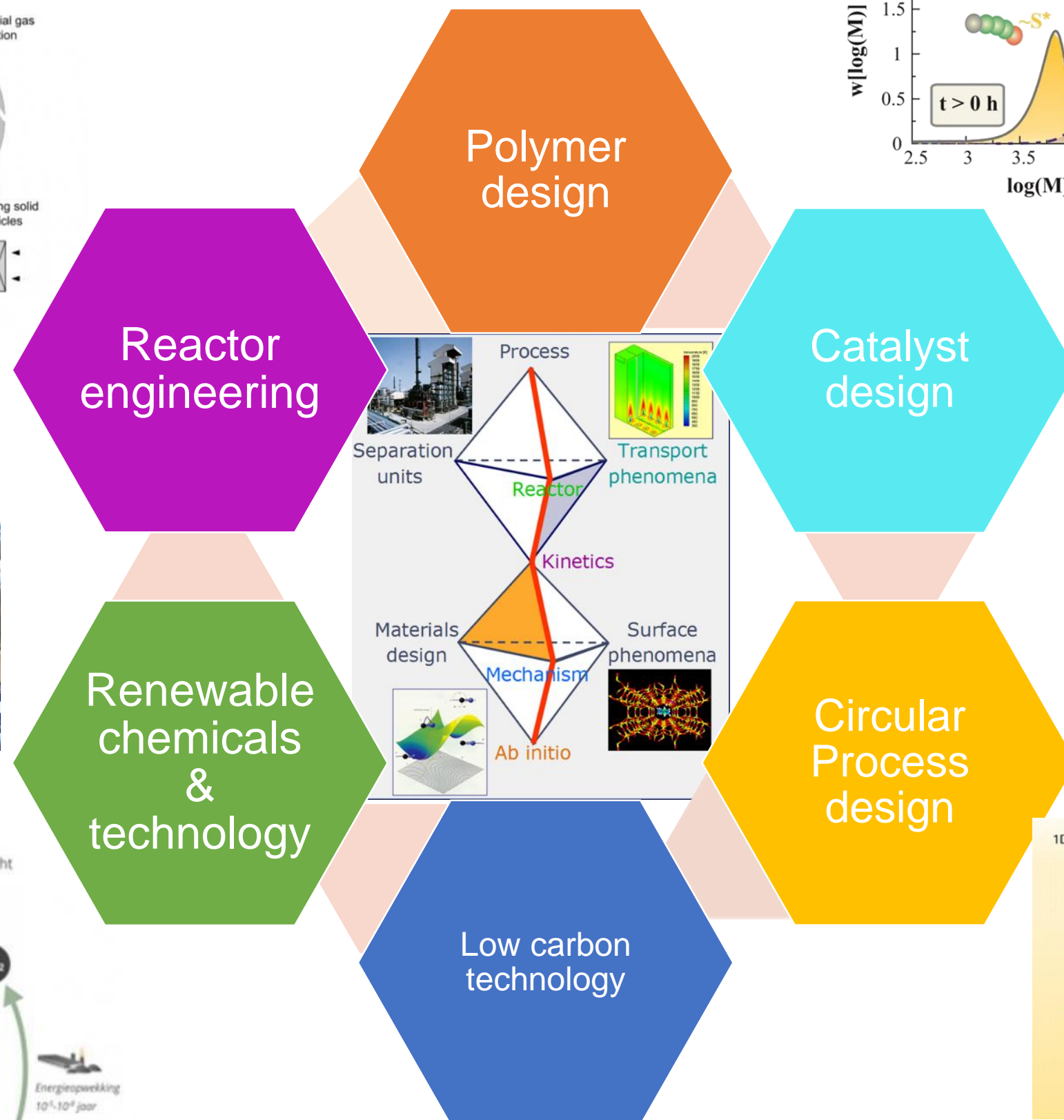
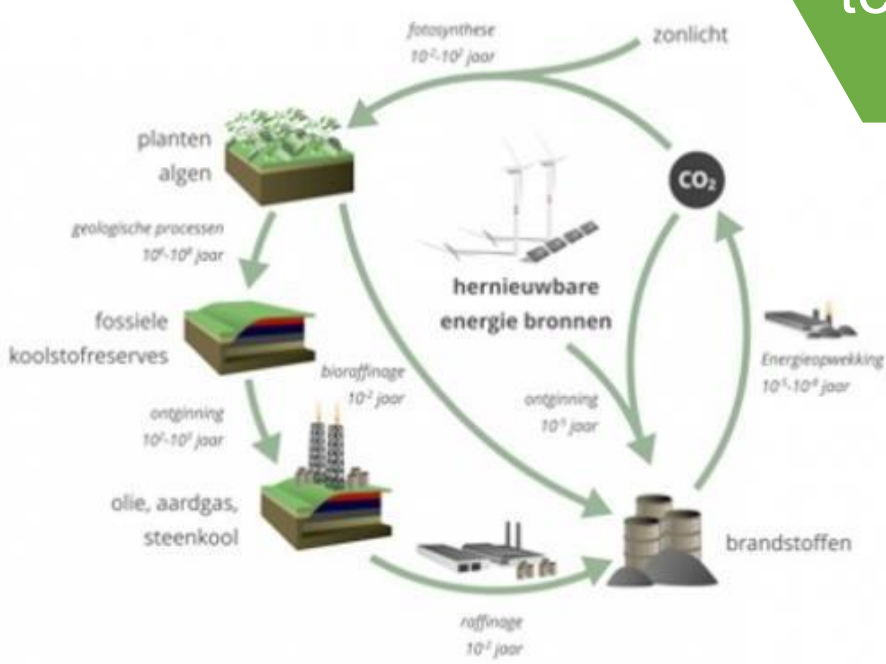
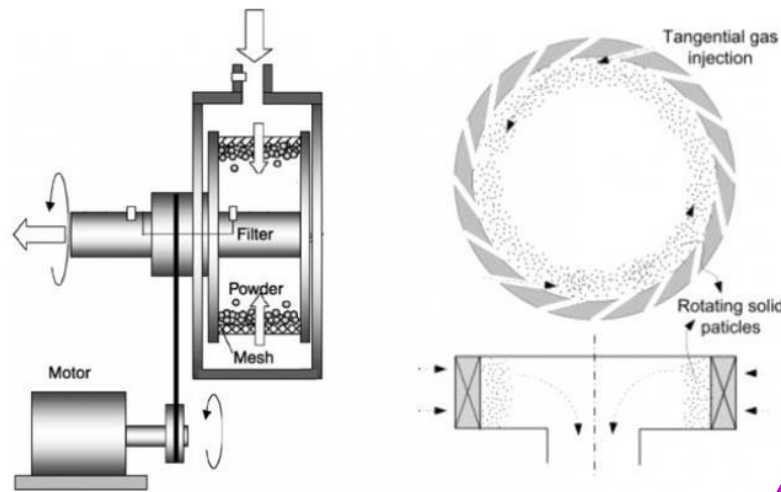


- Pilot plant Steam Cracker: 1
- Cold flow set-ups: 3
- Lab-scale set-ups: >10
- High-throughput kinetics reactor: 2
- TAP: 1
- Emulsion polymerization set-up: 1
- GCxGC (on line): 5
- Computing resources: 3 64-bit HPCCs (> 500 processor cores)



Commercialization of software packages for model-based production analysis and design

Communication along research themes

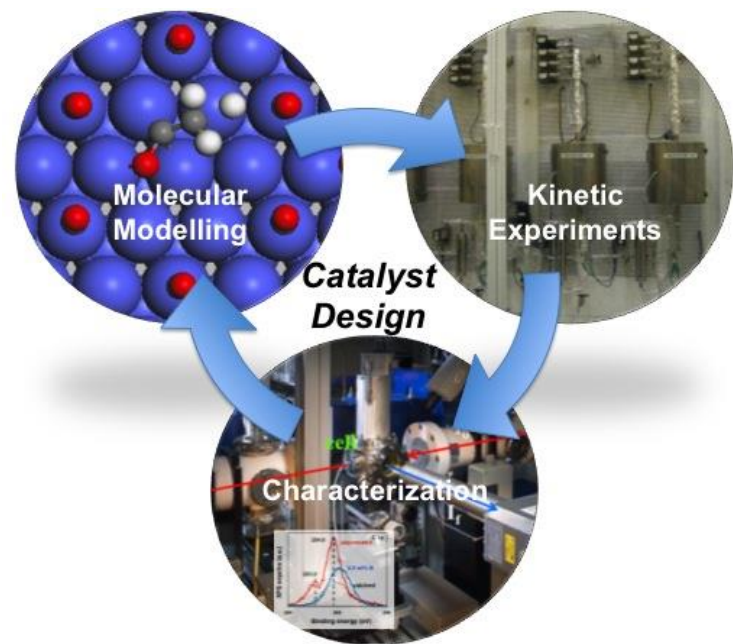


coordinators

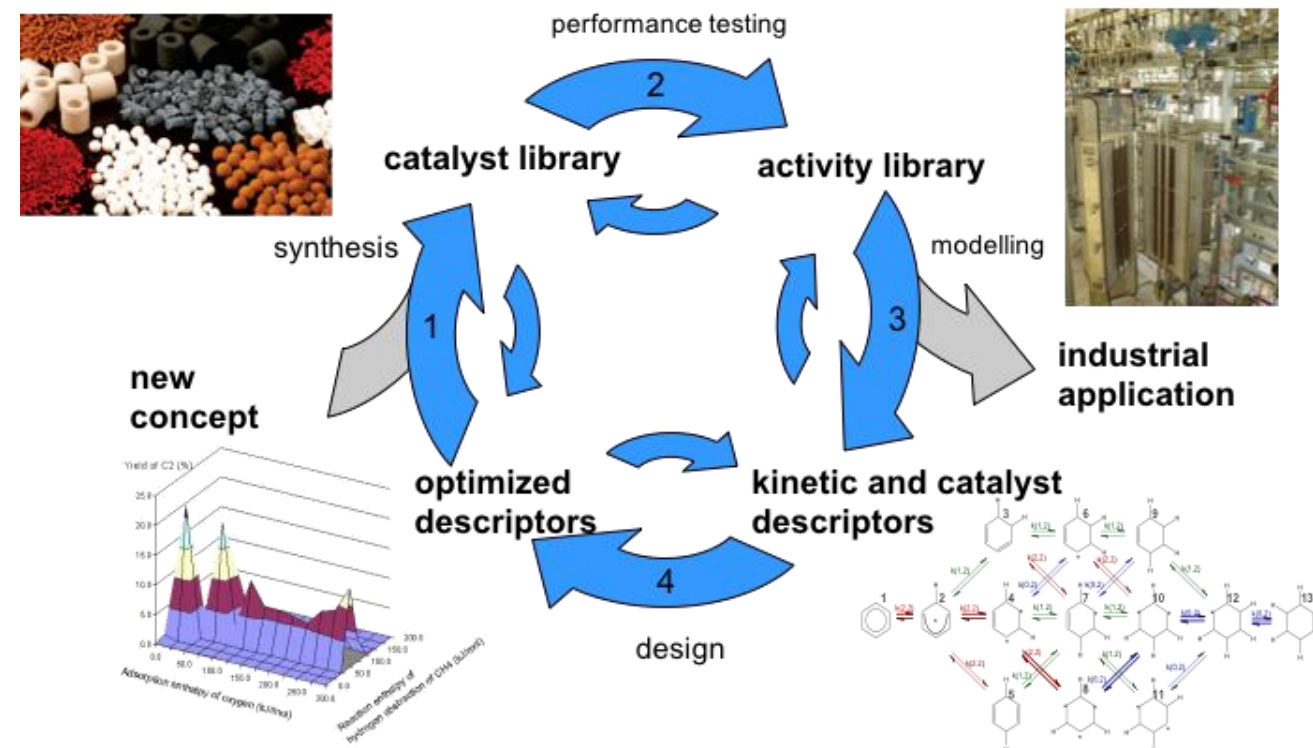
*every theme contains several topics;
each researcher is active in at least two topics and themes*

Theme 2: catalyst design

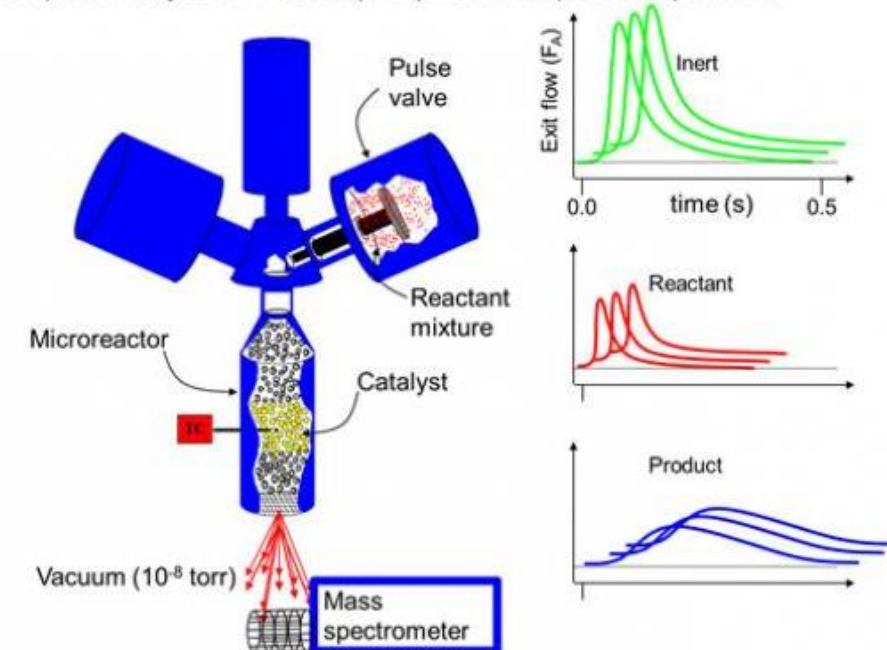
Modeling-guided



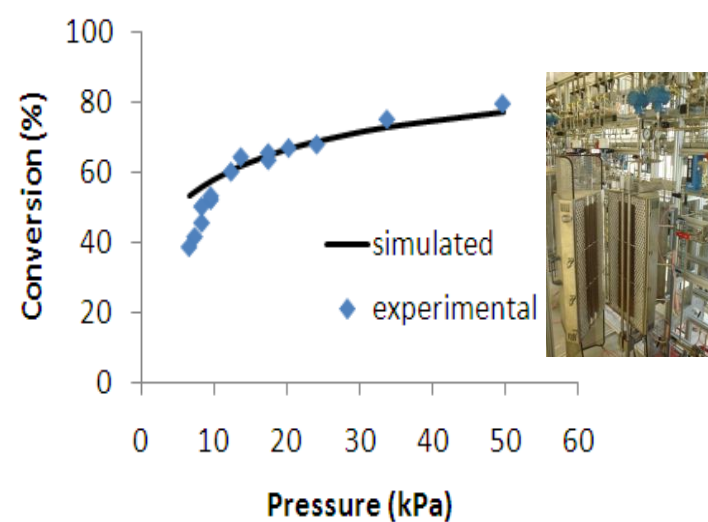
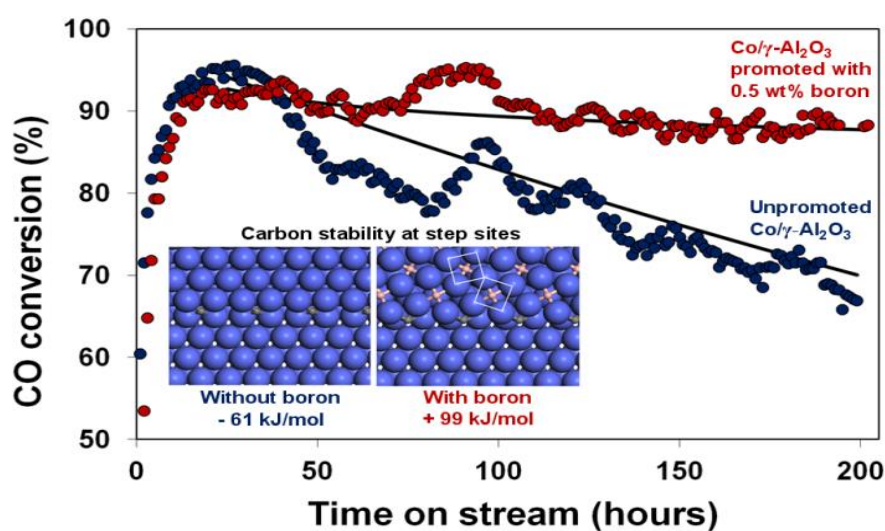
Kinetics-guided



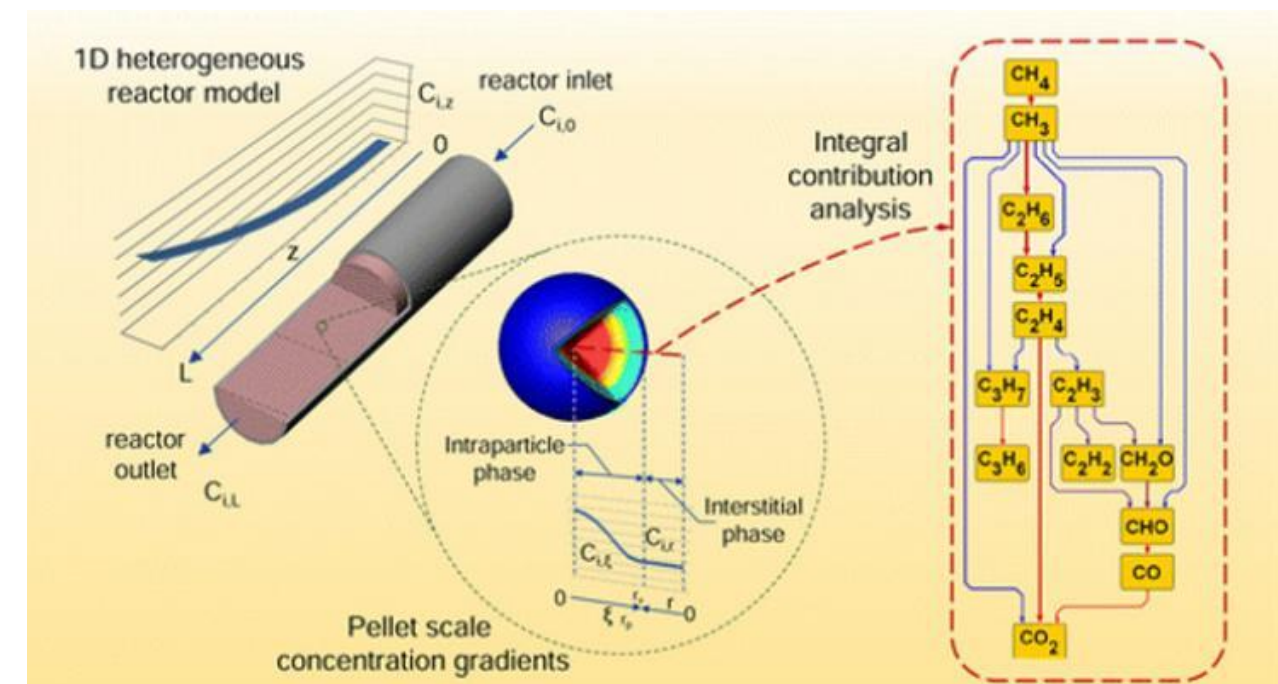
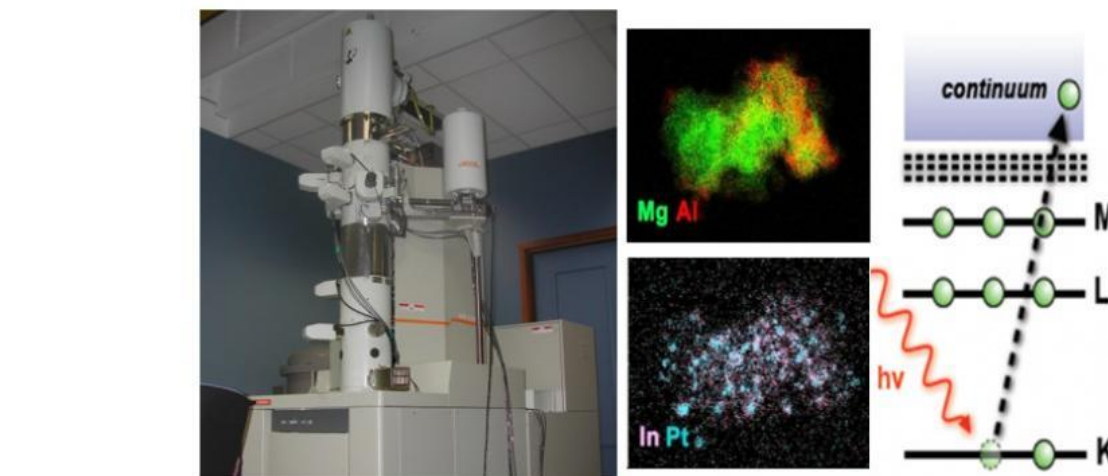
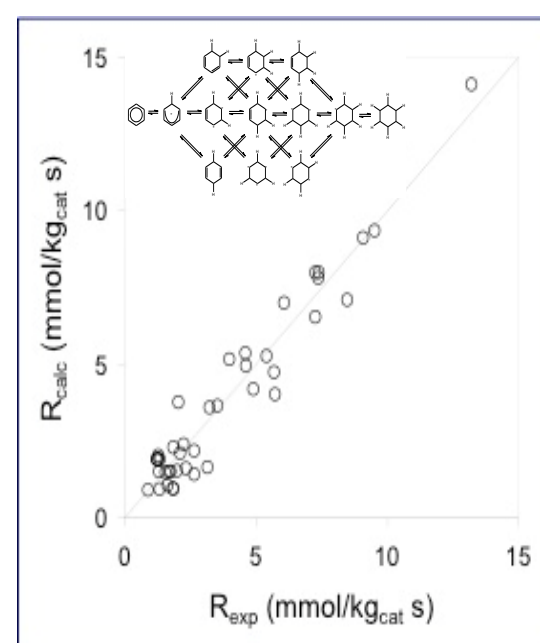
Temporal Analysis of Product (TAP) Pulse Response Experiment



Boron-promoted Co



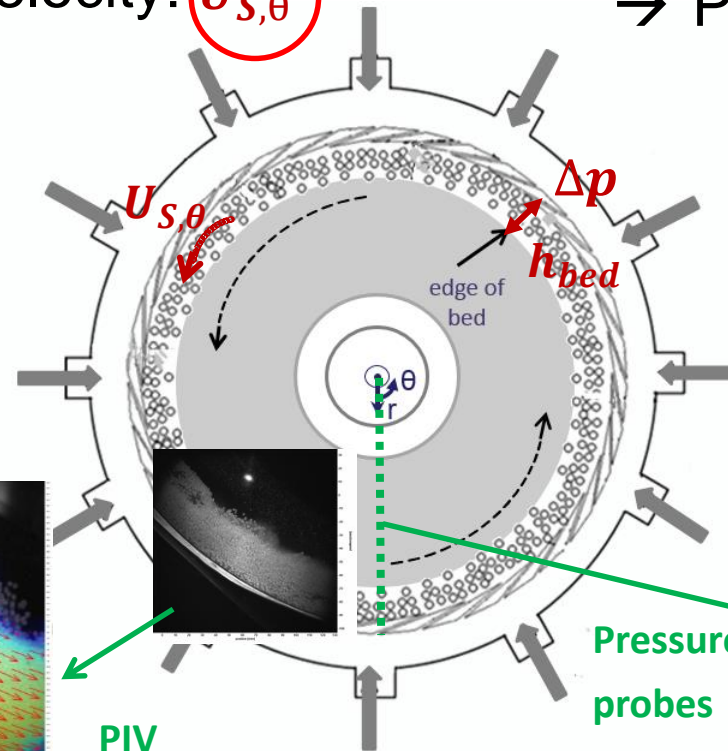
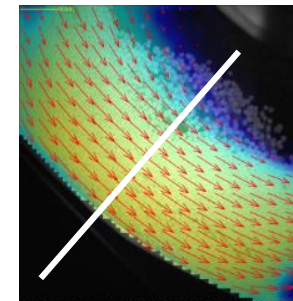
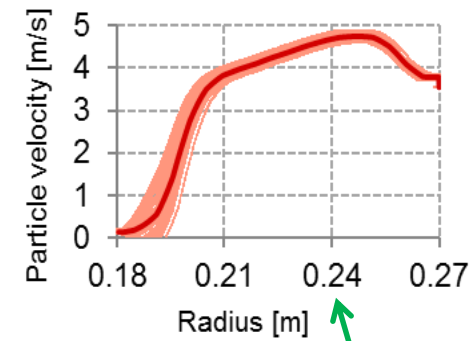
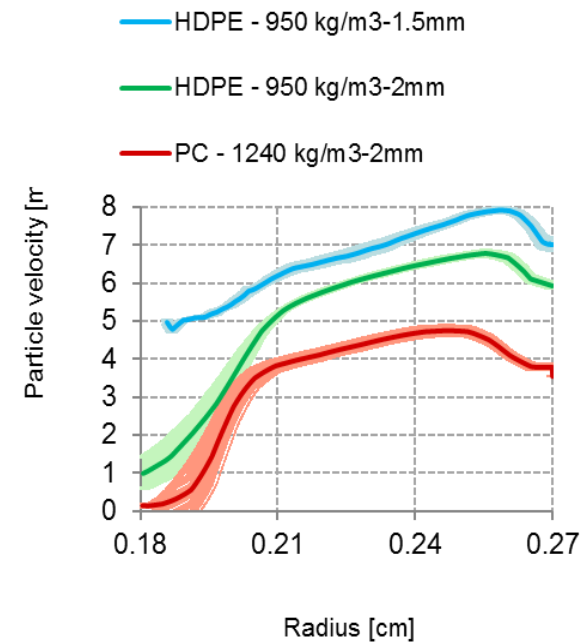
Accurate *ab initio* kinetics



Theme 3: reactor engineering

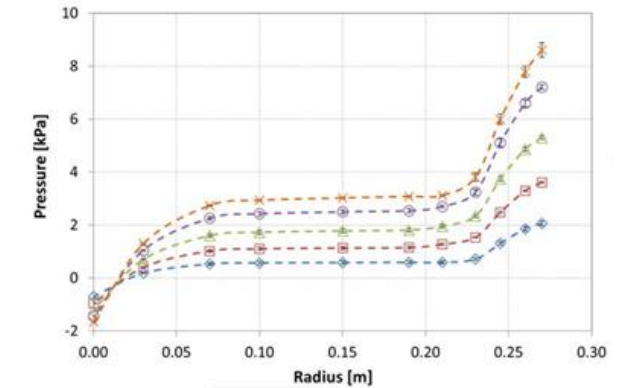
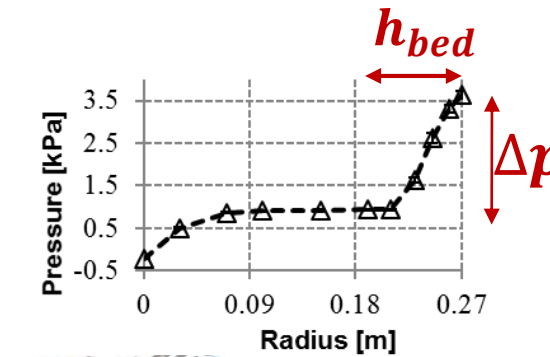
- Solids **Velocity**
Particle Image Velocimetry
of solid phase near wall

→ Particle azimuthal velocity: $U_{s,\theta}$

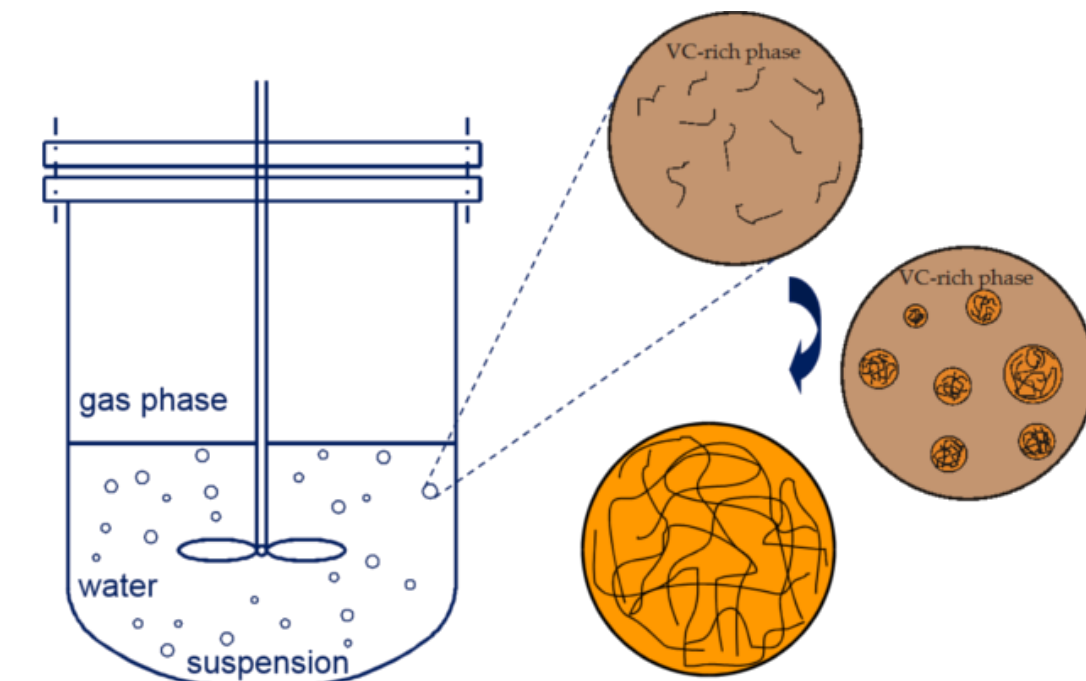
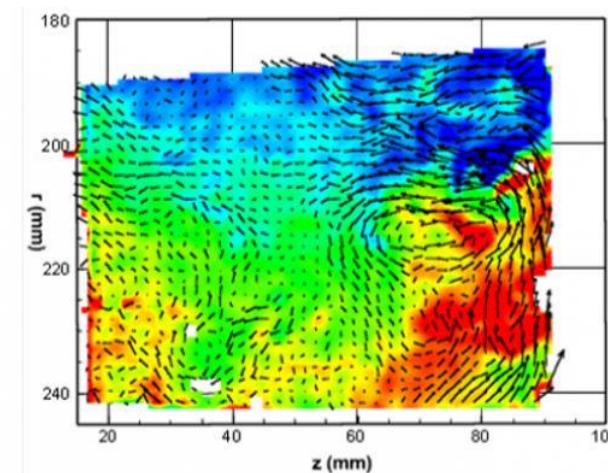
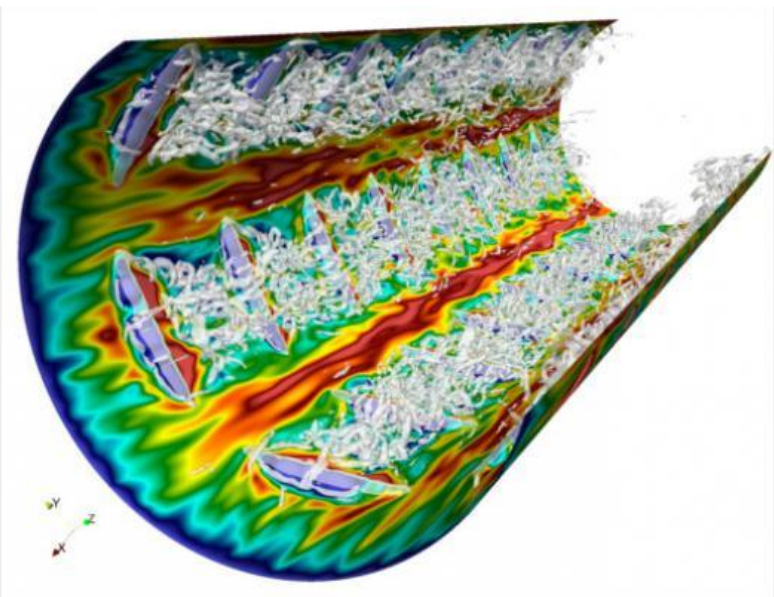


- Static **Pressure** profile
Pressure probes at wall

→ Pressure drop over bed: Δp

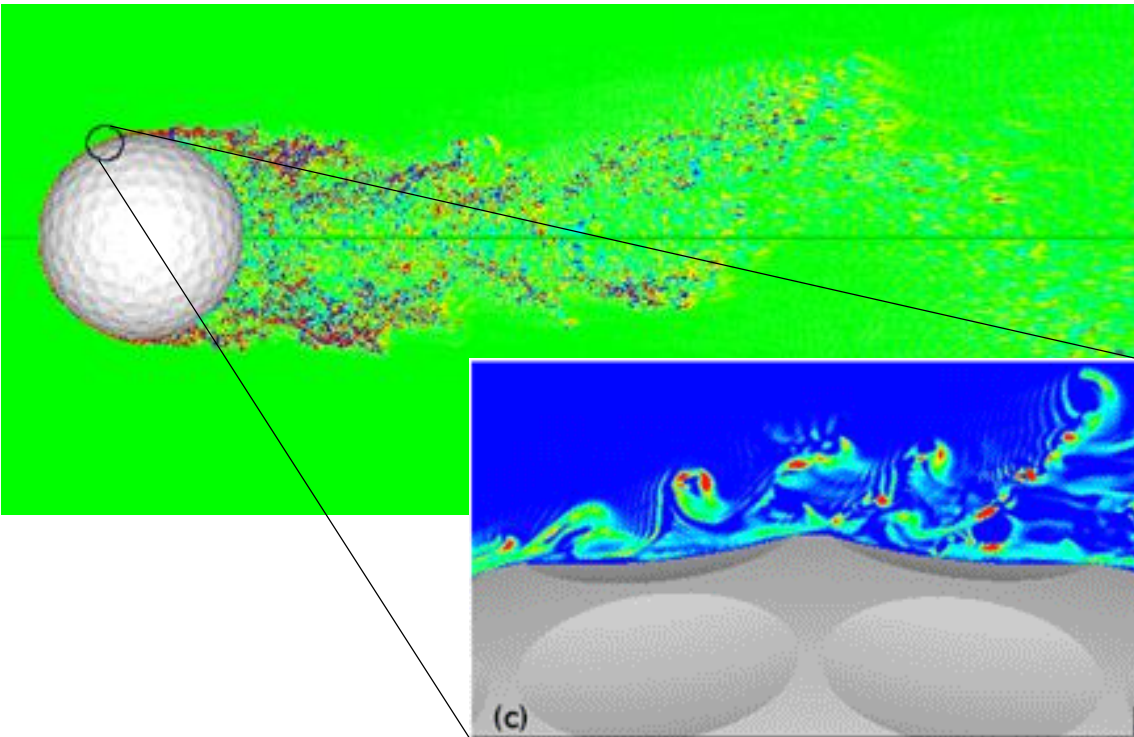


- Bed **Height**: h_{bed} → Void fraction: ϵ
| observation, Pressure profile

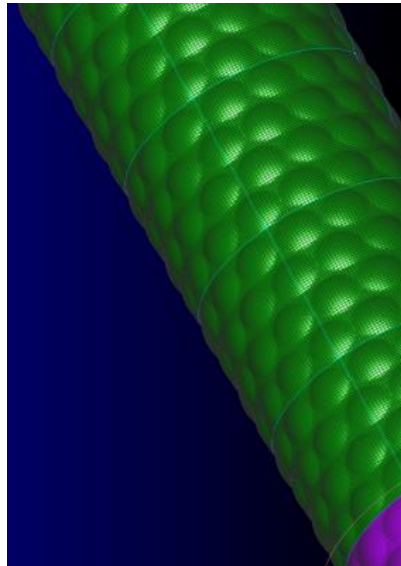
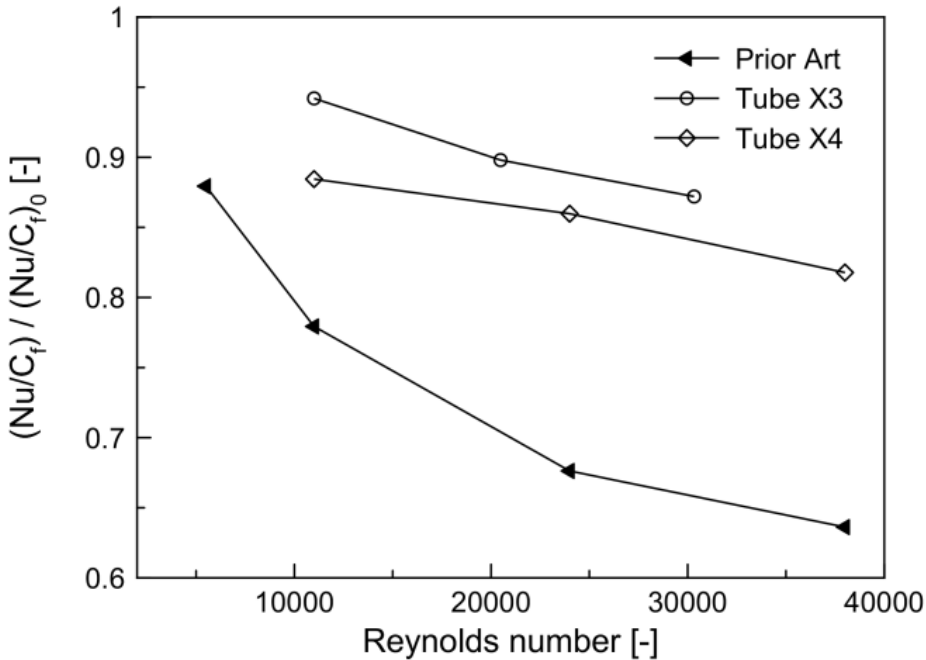


Dissemination also via patents

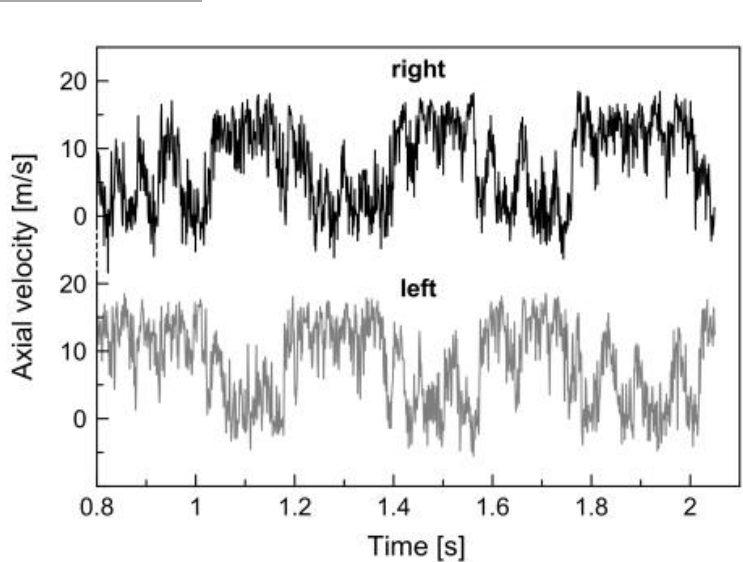
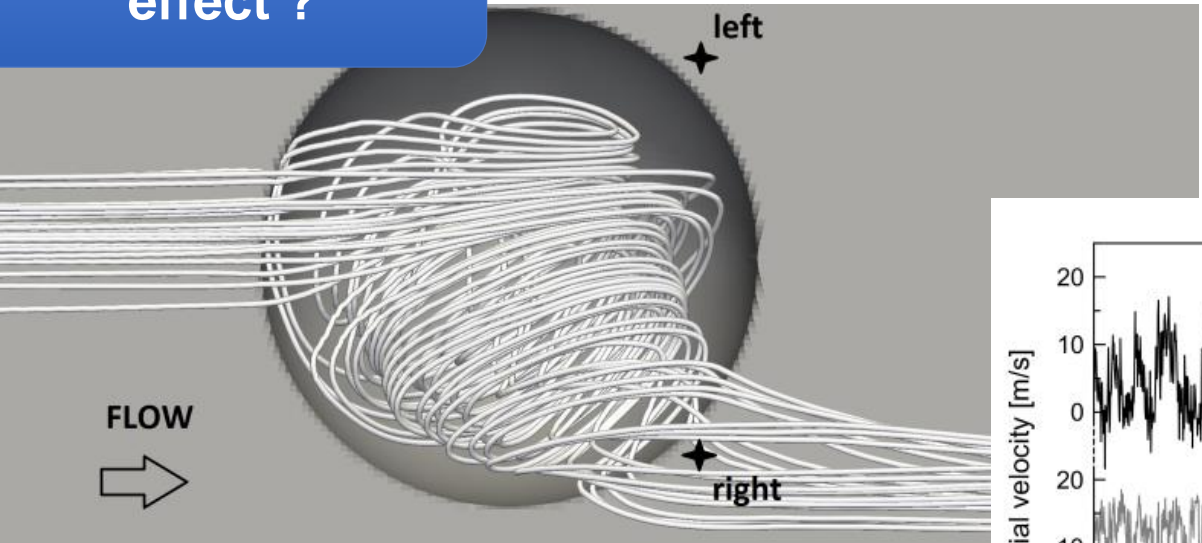
Well-known method of creating a turbulent boundary layer: **dimples** make golf balls fly further



Improved heat transfer performance



Self-cleaning effect ?



Performance in an industrial propane cracker

	Finned	Ribbed	Dimpled
ΔP	+29 %	+297 %	+87 %
TMT_{max}	-27 K	-53 K	-45 K
$r_{cokes, max}$	-6 %	-50 %	-39 %
$C_2H_4 + C_3H_6$	-0.32 %	+0.40 %	+0.34 %

(*) Van Cauwenberge et al. 2017, WO 2017178551 A1

Member of Centre for Sustainable Chemistry



Societal Challenge
Innovation Programs

Chemicals from
Renewable
Resources

Resource
Recovery

Sustainable Chemistry Ghent

Reaction and
Process
Design

Industrial
Biotech

Advanced
Materials



CHEMICAL ENGINEERING



INDUSTRIAL BIOTECH



CHEMISTRY FOR MATERIALS

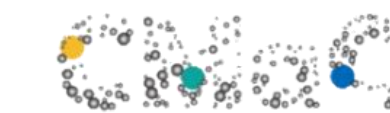
Key Enabling
Technologies

Business
Development

Collaboration:



Green
Chemistry
Ghent



First point of contact:
Dr. E. Delbeke

Director:
Prof. K. M. Van Geem



LCT core expertise and challenges

- **Design** of sustainable products and processes guided by:

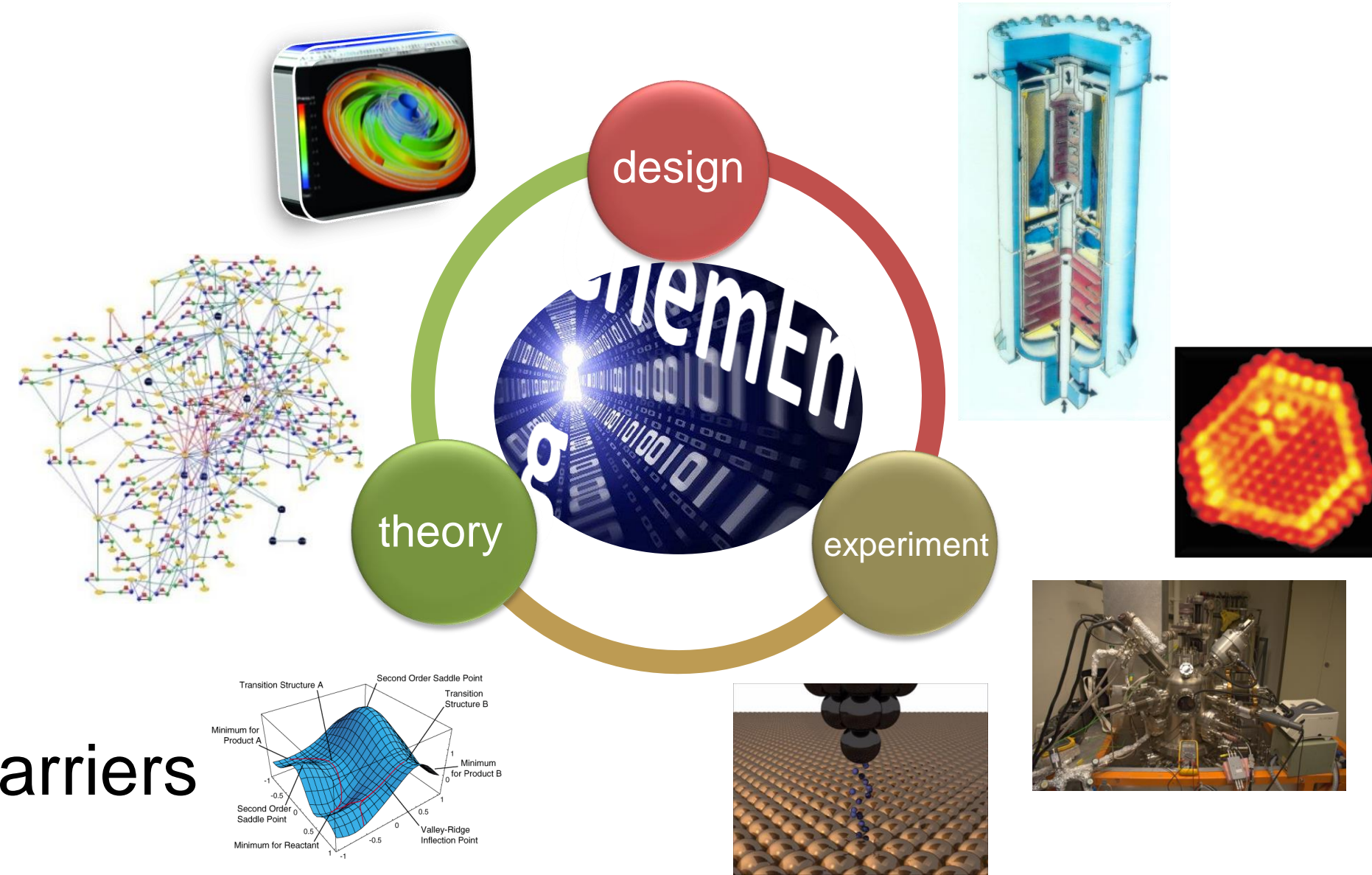
modeling of complex kinetics

combined with

complex transport phenomena

based on:

- first principles
- experimental validation



- **Application domains**

- transportation fuels and energy carriers
- chemicals
- functional materials: catalysts & nanostructured polymers
- reactors: 3D & vortex technology

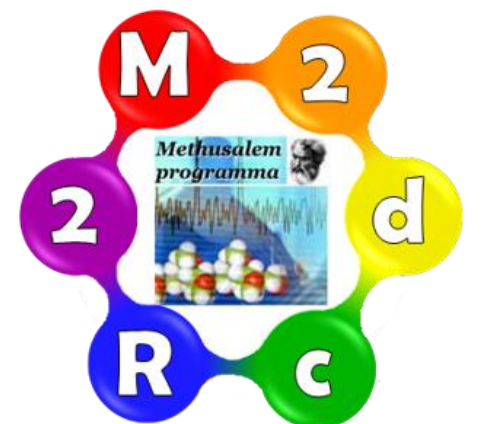
Funding from Flemish to European level



**Long Term Structural
Methusalem Funding of the
Flemish Government**



European Research Council
Established by the European Commission



Strong industrial interaction



ArcelorMittal



Aramco



LABORATORY FOR CHEMICAL TECHNOLOGY

Technologiepark 125, 9052 Ghent, Belgium

E info.lct@ugent.be

T 003293311757

<https://www.lct.ugent.be>

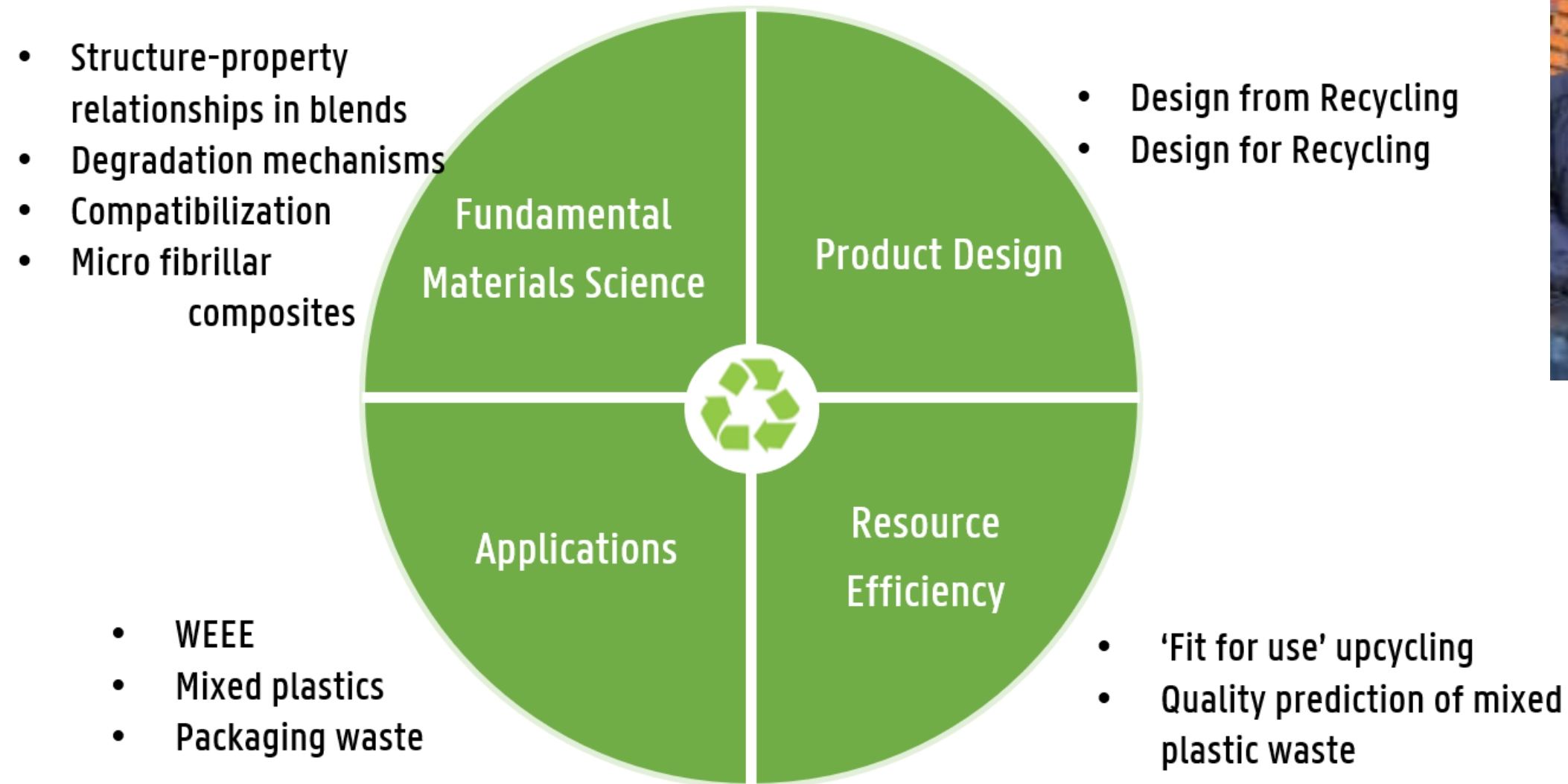


MECHANICAL RECYCLING OF POLYMERS

@ GHENT UNIVERSITY

prof. Kim Ragaert

CPMT – TEAM RECYCLING

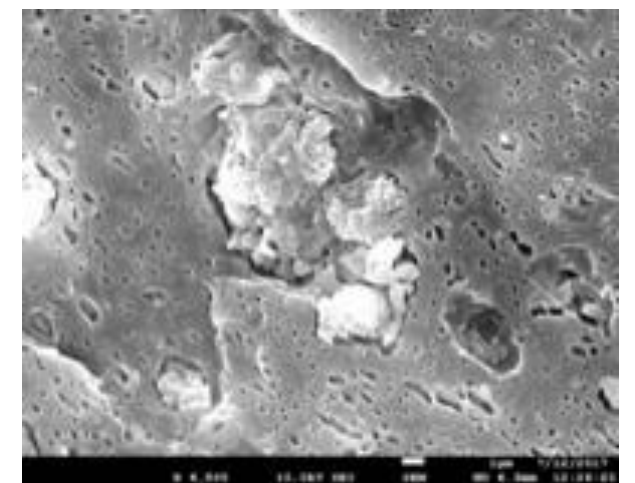


Our mission is to contribute to the circular economy by demonstrating the sustainable potential of plastics.

This is achieved by transferring fundamental materials science to improved industrial processing of recycled plastics.

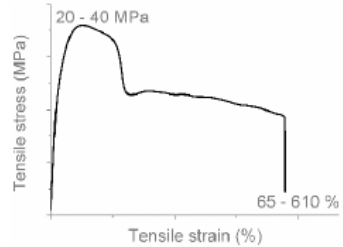

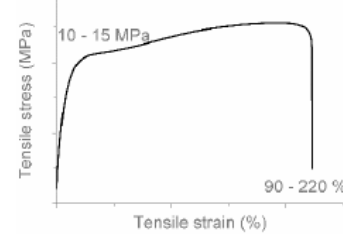

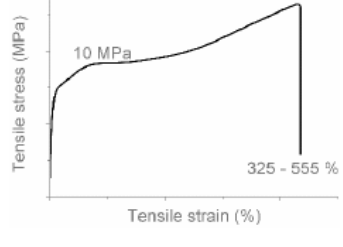

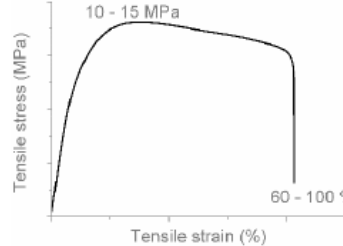

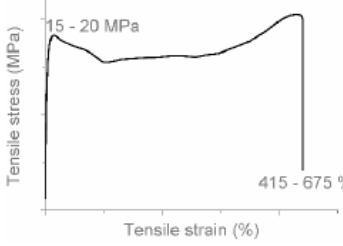

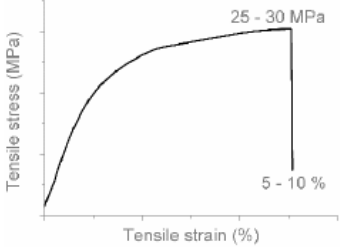

EQUIPMENT AT CPMT

- **Extrusion:** various single screw, twin screw (compounding TSE, conical TSE, reactive TSE) for sheet, filament and (blown) foil
- **Multilayer Flaminco** (unique Benelux): up to 5 layers (3 materials) in sheet and foil
- **Injection moulding** up to 80T
- **Thermoforming**
- **Characterization:** physicochemical (DSC, FTIR, TGA), optical (SEM, POM), mechanical (tensile, impact, peel,...), ESCR, conductivity,...
- **3D printing** (various low cost, Stratasys UPrint SE, Felix 3, Pollen extrusion-based, Spiderbot, own developments)



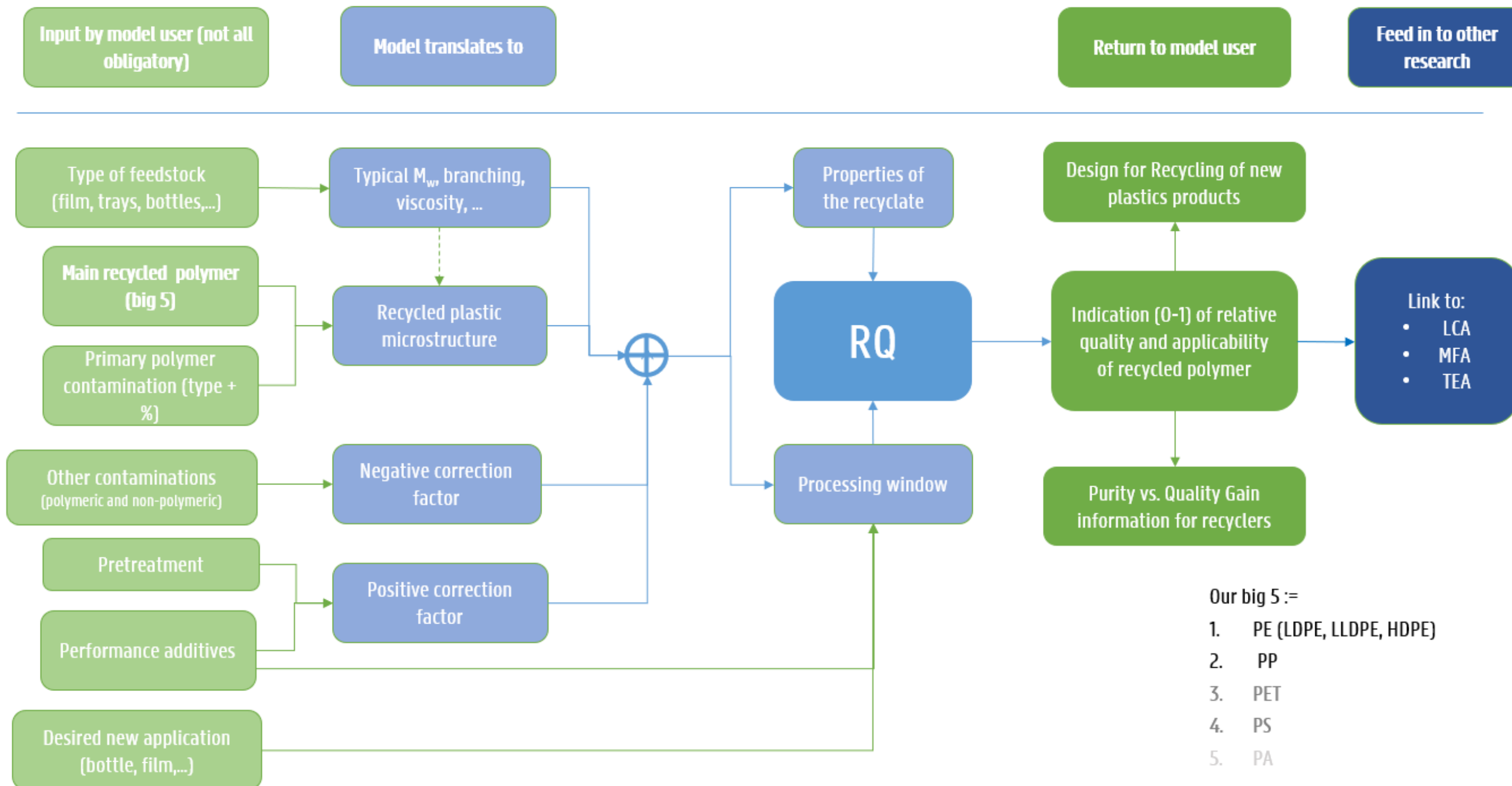
'QR' – THE QUALITY FOR RECYCLING OF A PRODUCT / WASTE STREAM

- Core theme of the research group
 - Focus thermoplastics, 'big 5' of packaging
 - To go beyond 'observatory recycling studies'
 - Ties heavily into [materials science of polymers](#)
- 'contamination' = other thermoplastics, tie/barrier layers, adhesives, inks, labels,....
- 'quality' = (relative to uncontaminated virgin)
 - mechanical properties
 - Processability / fit-for-application
 - Other (odour, colour,...)

Code	Curve	Test Bar Deformation	Deformation Mechanism Polymers/Blends
A			Neck shear yielding HDPE (pure, ϵ_b : 270%–465%) PP (pure, ϵ_b : 70%)
B			Local shear yielding LDPE (pure, ϵ_b : 90%–115%)
C			Uniform shear yielding with strain hardening LLDPE (pure, ϵ_b : 430%–555%)
AB			Combined (neck + local) shear yielding LDPE + HDPE LDPE + PP
AC			Progressive shear yielding with strain hardening LLDPE + HDPE
AA			Brittle HDPE + PP

THE RQ OF A PRODUCT / WASTE STREAM – MODELED *RECYCLING*

QUALITY



Prof. Dr. Kim Ragaert
Sustainable Use and Recycling of Polymers

Chair of CAPTURE-Plastics to Resource
capture-resources.be

kim.ragaert@ugent.be
+32 9 331 03 91

Ghent University
Faculty of Engineering and Architecture
MATCH – CPMT (cpmt.ugent.be)

Tech Lane Ghent Science Park – campus A
Technologiepark 130
9052 Zwijnaarde, BE



Key publications:

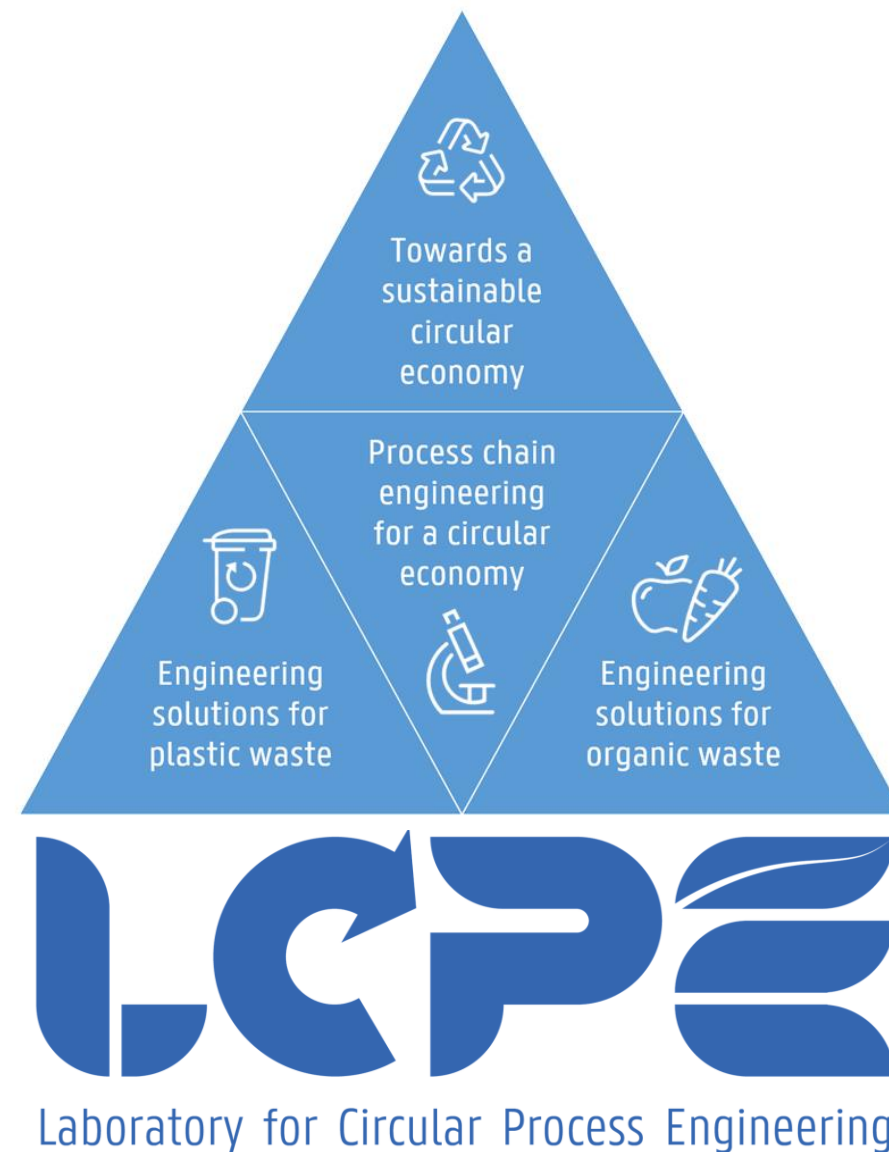
- Astrid Van Belle , ..., and Kim Ragaert. Microstructural contributions of different polyolefins to the deformation mechanisms of their binary blends. (2020) Polymers.
- Kim Ragaert, Sophie Huysveld, Gianni Vyncke, Sara Hubo, Lore Veelaert, Jo Dewulf and Els Du Bois. Design from recycling: A complex mixed plastic waste case study. (2019) Resources, Conservation and Recycling. 155.
- Sophie Huysveld, Sara Hubo; Kim Ragaert; Jo Dewulf. Advancing circular economy benefit indicators and application on open-loop recycling of mixed and contaminated plastic waste fractions, Journal of Cleaner Production 211 (2019) .
- Thoden van Velzen U., Brouwer M., Augustinus A., Soethoudt I., De Meester S. and Ragaert K. Predictive model for the Dutch post-consumer plastic packaging recycling system. Waste Management 71 (2018), 62–854.
- Ragaert K., Delva L. And Van Geem K. (2017). Mechanical and Chemical Recycling of Solid Plastic Waste. Waste Management 69 (2017) 24–58.
- Sofie Huysman, Jonas De Schaepmeester, Kim Ragaert, Jo Dewulf and Steven De Meester. Performance indicators for a circular economy: A case study on post-industrial plastic waste. Resources, Conservation and Recycling 120 (2017)
- [Kim Ragaert. Plastics Rehab. TEDx Vlerick, Ghent, April 2019.](#)

LABORATORY FOR CIRCULAR PROCESS ENGINEERING

Prof. Steven De Meester

OUR GROUP

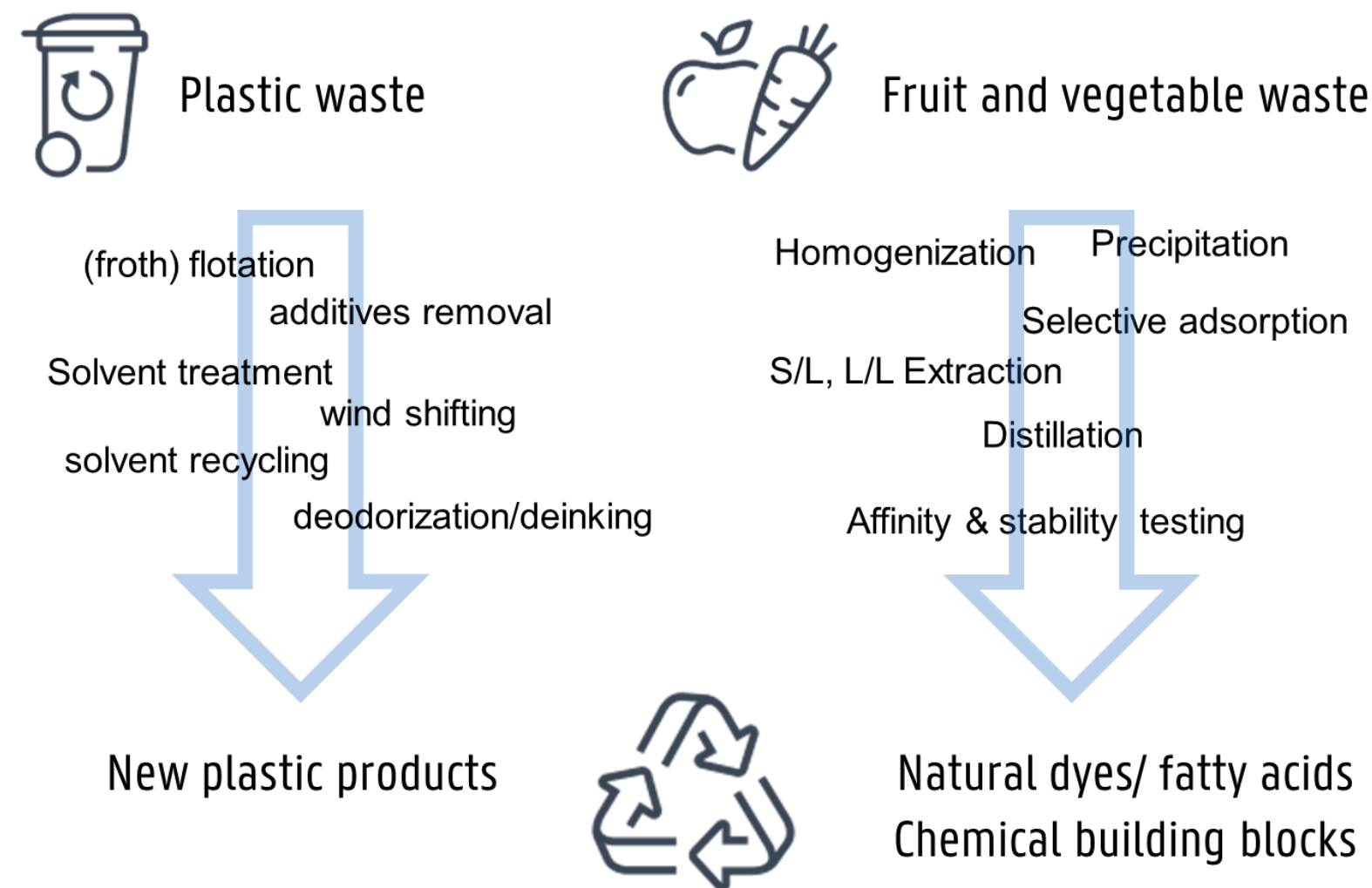
- Ghent University – Faculty of Bioscience Engineering – Department of Green Chemistry and Technology – Laboratory for Circular Process Engineering
- Started in 2016. Now a team of around 20 PhD students & 2 technicians
- Teaching:
 - Chemical engineering
 - Downstream processing
 - Thermal operations
 - Process intensification
 - Waste Management
 - Environmental Management



MAIN FOCUS




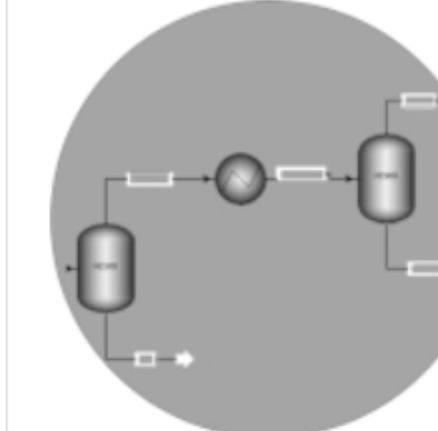
Strategy

- ➔ Characterisation of waste/product by chemical analysis
- ➔ Modeling the process (ASPEN) and the (new) process chain (MFA)
- ➔ Pilot experiments to develop or validate models
- ➔ Basic economic/environmental assessment

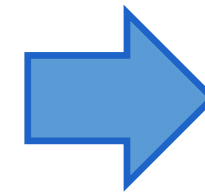


*example processes depicted

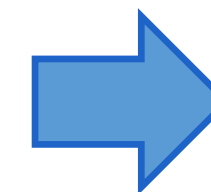
INFRASTRUCTURE

 <p>Sample preparation</p>	 <p>Analytics</p>	 <p>Unit operations</p>	 <p>Process design with</p>
<ul style="list-style-type: none"> •Microwave digestion •Cryogenic mill •Shredder •Dry ashing •Sieving 	<ul style="list-style-type: none"> •GC-MS •GC-FID •HPLC •FT-IR •TGA-IR •DSC •UV-VIS •ICP-OES •AAS •Viscometer: Rotary and kinematic •Colorimeter •Conductometer •Particle sizing (Laser Particle sizer, sieve analysis) 	<ul style="list-style-type: none"> •Solid-liquid extraction •Liquid-liquid extraction •Continuous and batch distillation •Density and froth flotation •Pilot-scale friction washer •Air classification/wind shifting •Hydrocyclone •Decanter centrifuge •Drying •Adsorption/desorption •Precipitation •Counter current gas absorption/stripping •Filtration: pressure and sand filtration •Column testing (Active carbon, Ion Exchange,...) 	<ul style="list-style-type: none"> •ASPEN Plus® •Aspen HYSYS •Aspen Heat Exchanger Design and Rating •DoE with JMP and RStudio •MATLAB •Python •Material flow analysis

FROM OPEN-LOOP RECYCLING ...

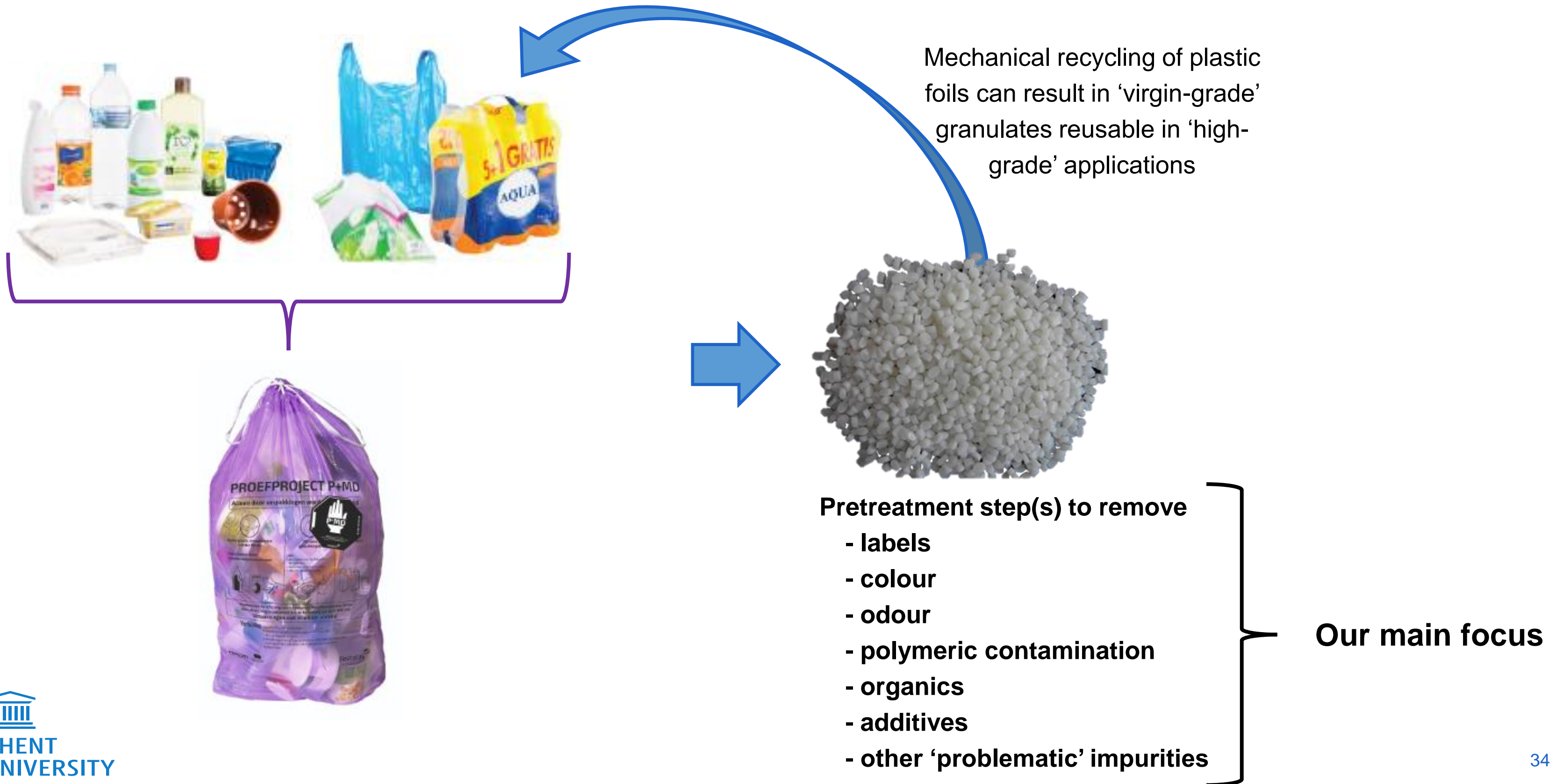


Mechanical recycling of plastic foils results in black granulates



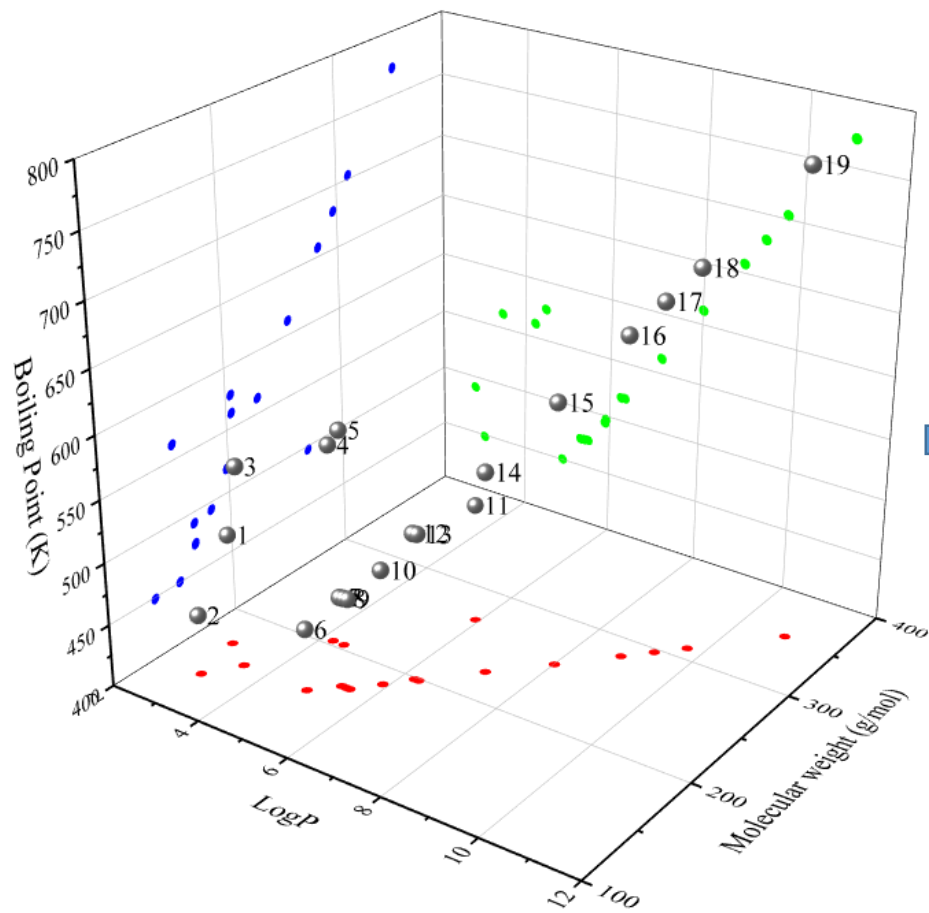
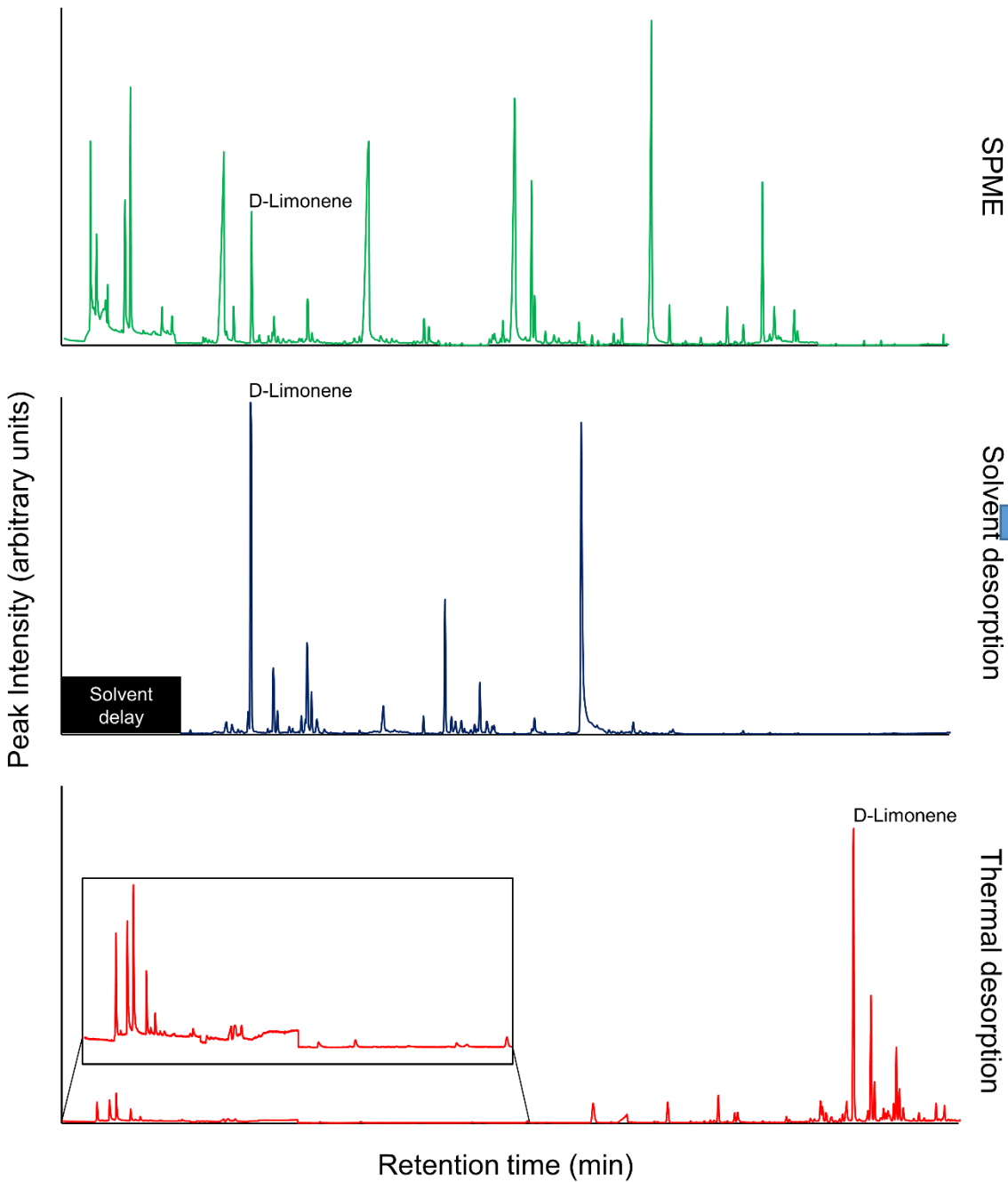
Black granulates can only be used in 'low-grade' applications like garbage bags

... TO CLOSED-LOOP RECYCLING



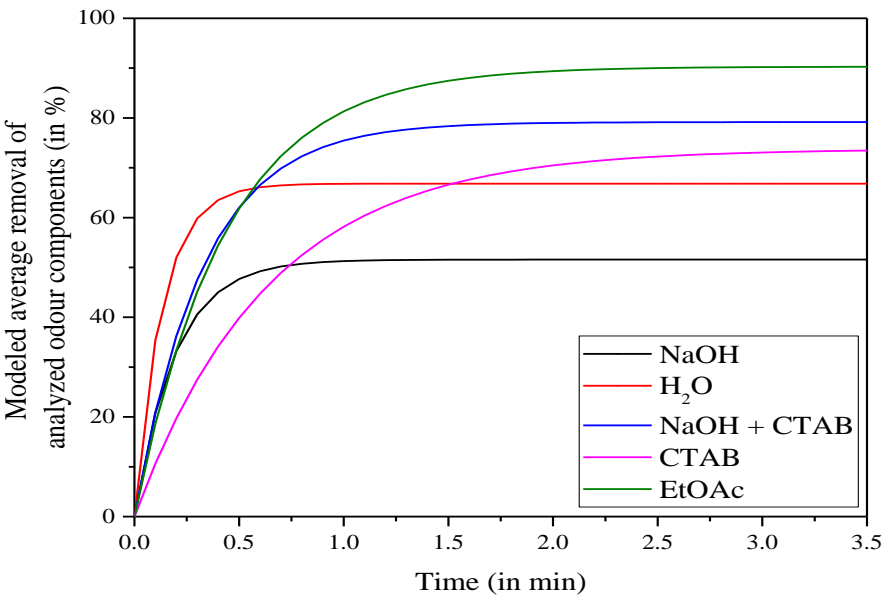
DEODORIZATION OF PLASTIC WASTE

Comparison of 3 different GC-MS methods



Selection of odor components with varied boiling point, LogP value, and MW

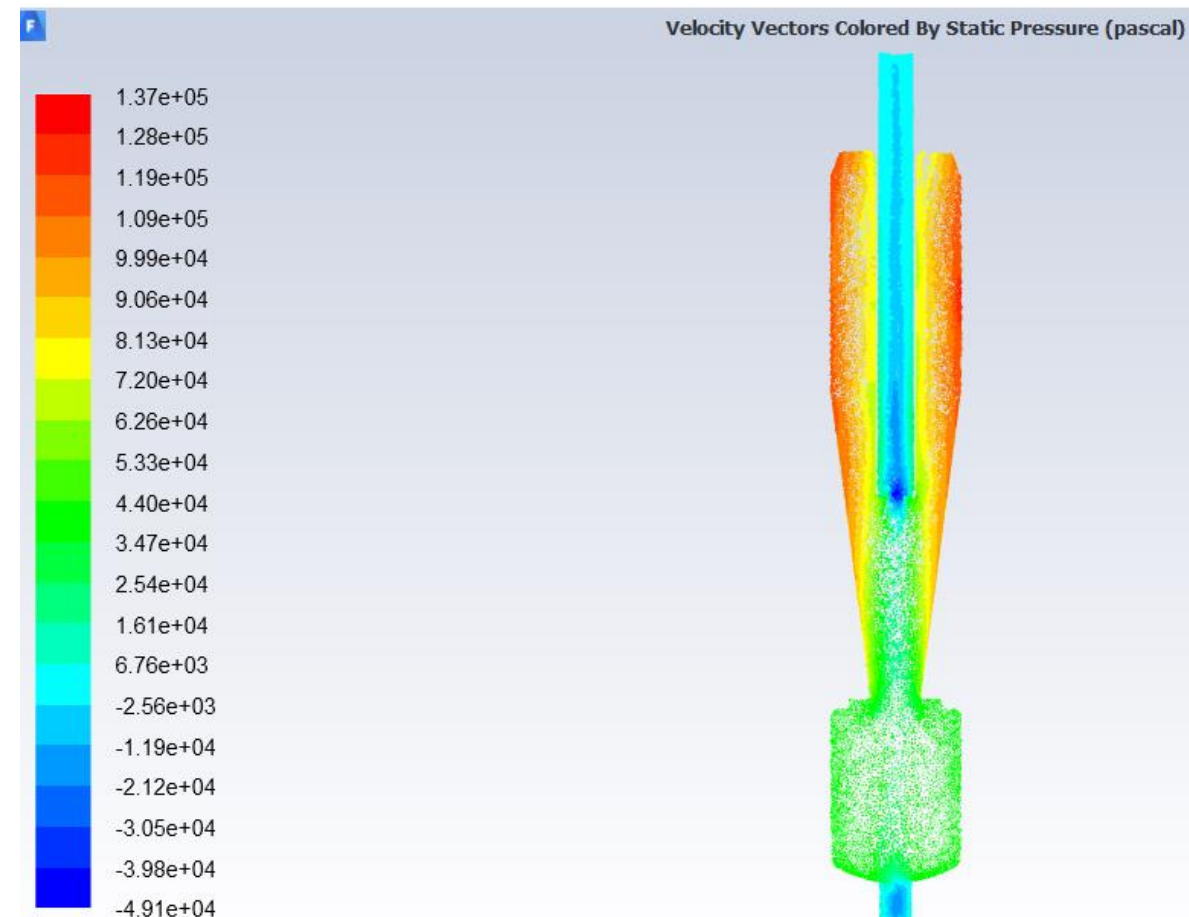
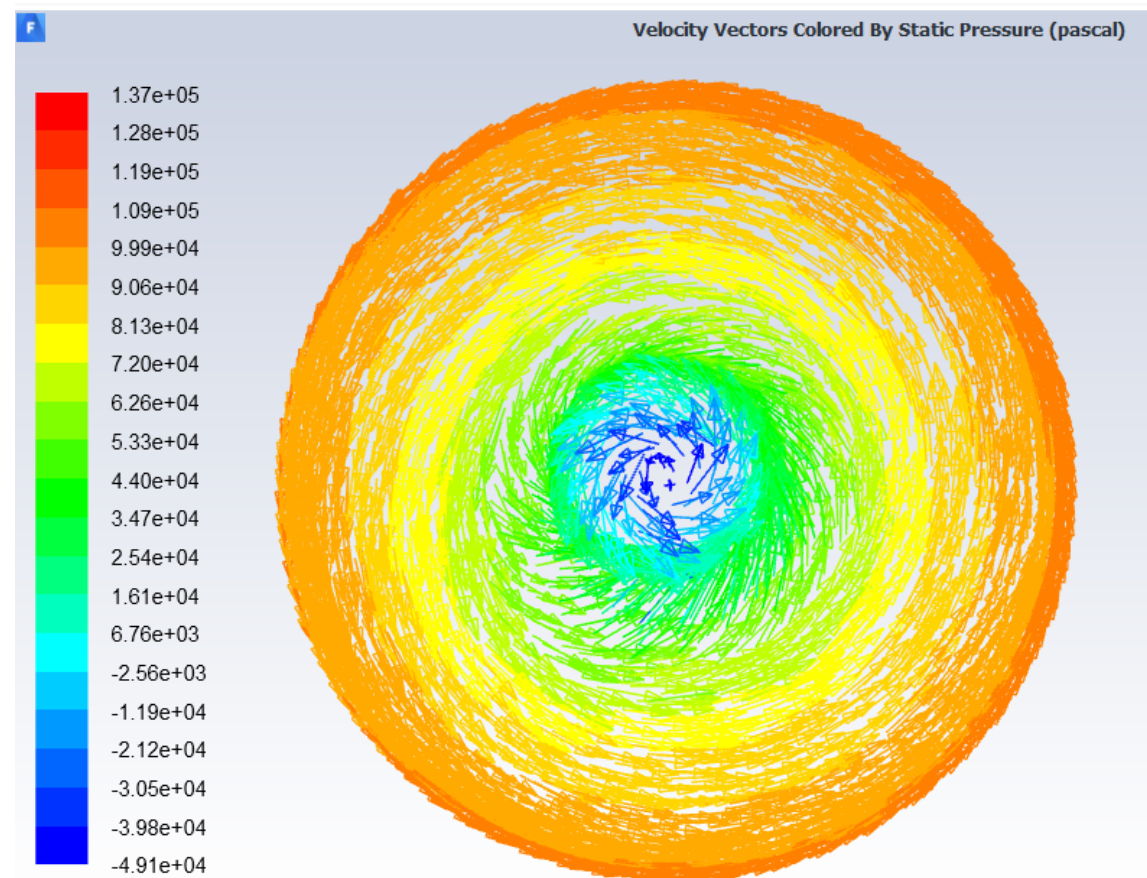
Kinetic model	Equations
Zero-order	$\frac{dq}{dt} = -k_{0,des}$
First order	$\frac{dq}{dt} = -k_{1,des} * q$
Second-order	$\frac{dq}{dt} = -k_{2,des} * q^2$
Pseudo first-order	$\frac{dq}{dt} = k_{p1,des} * (q_e - q)$
Pseudo second-order	$\frac{dq}{dt} = k_{p2,des} * (q_e - q)^2$
Reversible first-order	$\frac{dq}{dt} = -k_{RFO,1} * q + k_{RFO,2} * C$
Langmuir	$\frac{dq}{dt} = k_{LK} \left[\frac{(q_0 - q) * m}{V} * (q_{mL} - q) - \frac{1}{b_{LK}} q \right]$



Comparison of various conventional and advanced washing treatments

FLOTATION SEPARATION

— Plastics floating/sinking behavior?

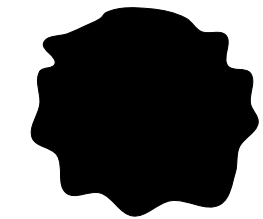


$$C_D = \frac{24}{Re_p} \left(\frac{1 - \Psi}{Re_p} + 1 \right)^{0.25} + \frac{24}{Re_p} (0.1806 Re_p^{0.6459}) \Psi^{-Re_p^{0.08}} + \frac{0.4251}{1 + \frac{6880.95}{Re_p} \Psi^{5.05}}$$

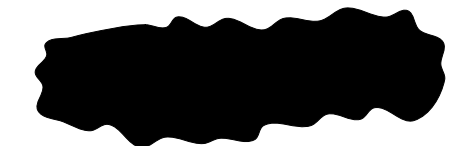
High Φ and low χ



Low Φ and low χ



High Φ and high χ



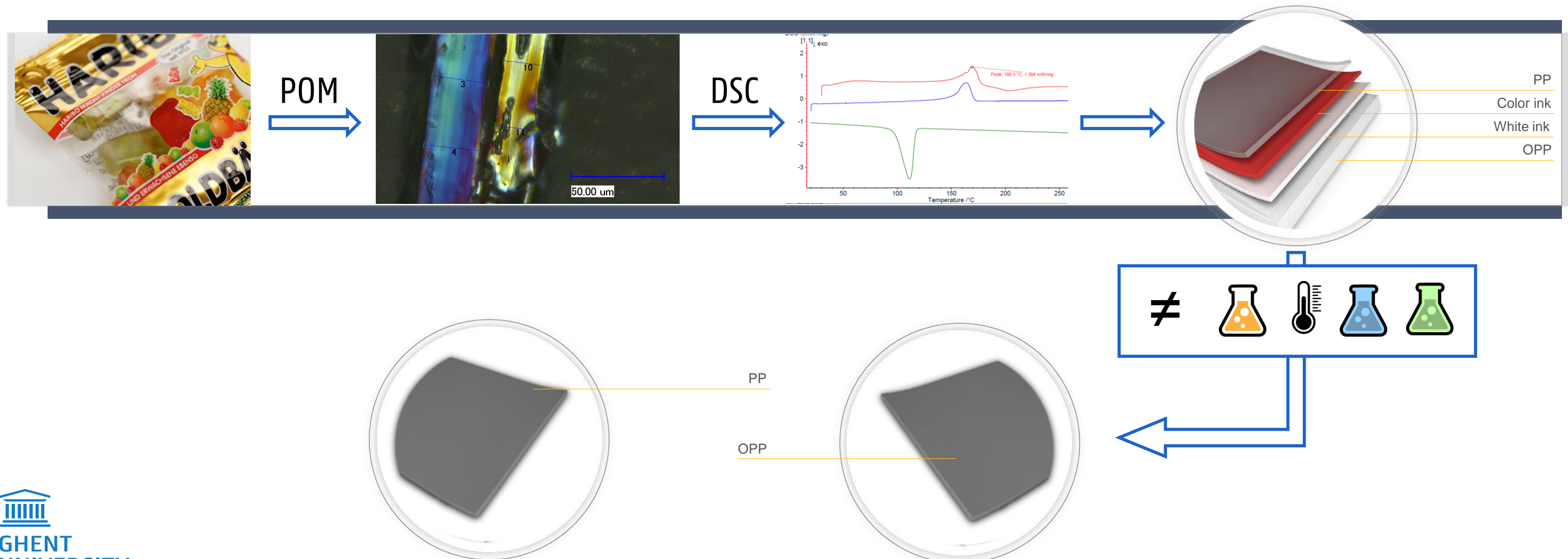
Low Φ and high χ

DEINKING / DELAMINATION

Deinking / delamination

Quantitative overview of removal efficiencies of impurities by existing washing and separation steps

- Deinking / delamination experiments on representative products
 - Optimizing procedure: testing of different media and different temperatures



DELAMINATION & DEINKING OF PLASTICS

Deinking and delamination of 'real' packaging

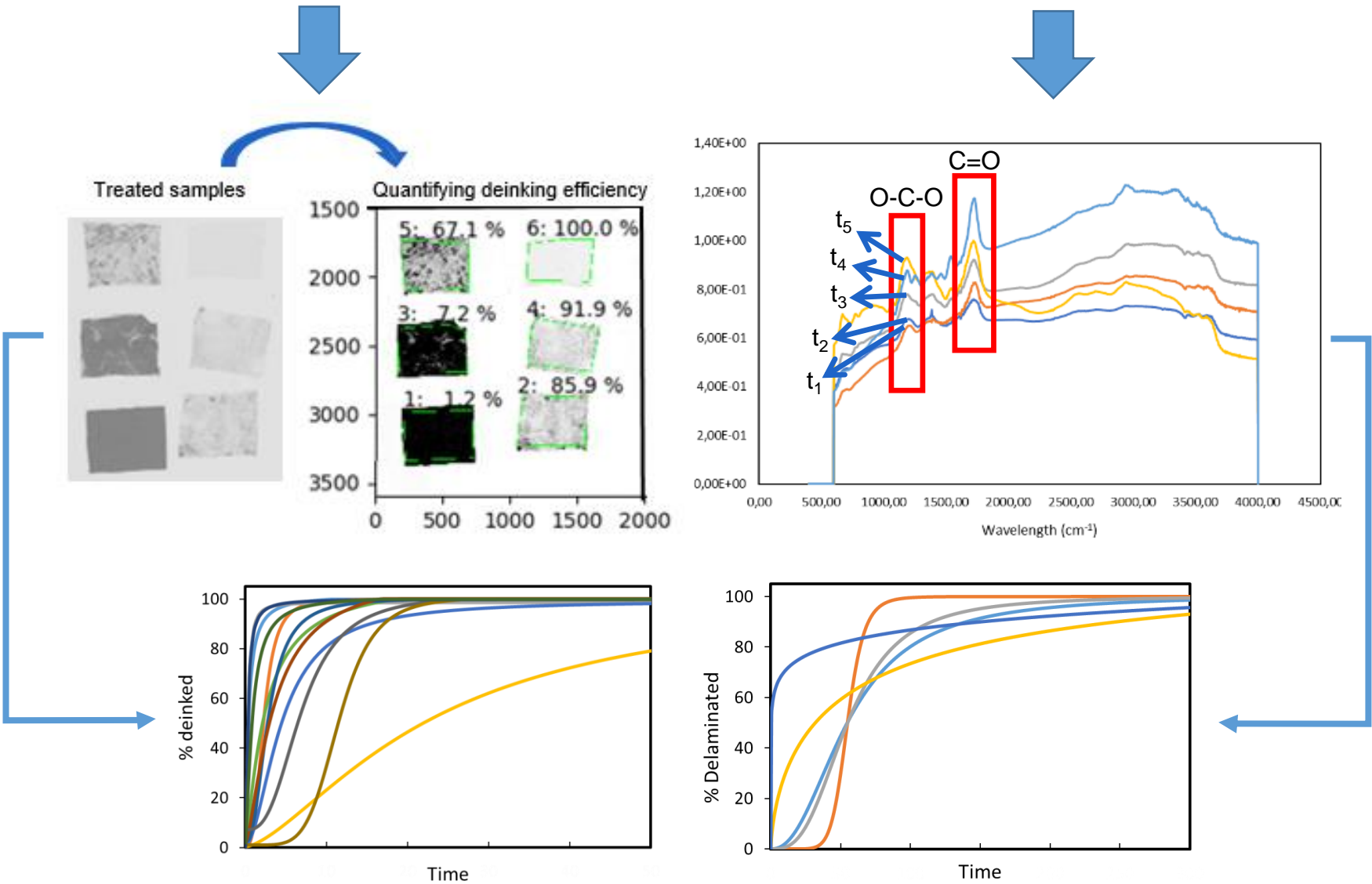


*Patent application filed

Process optimization via standardized samples

Quantification of deinking via image color mapping

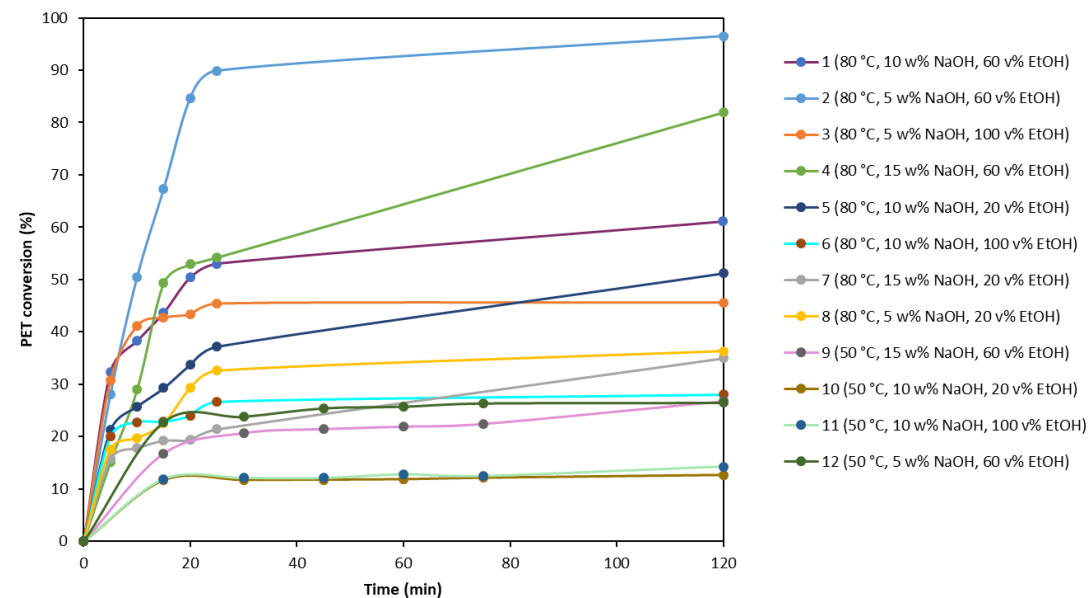
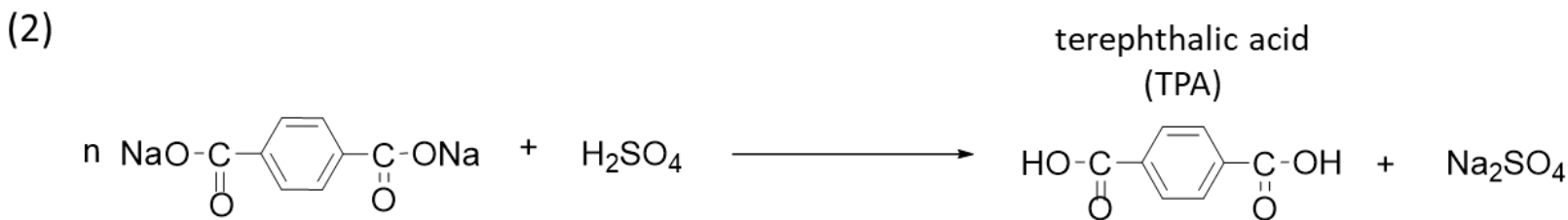
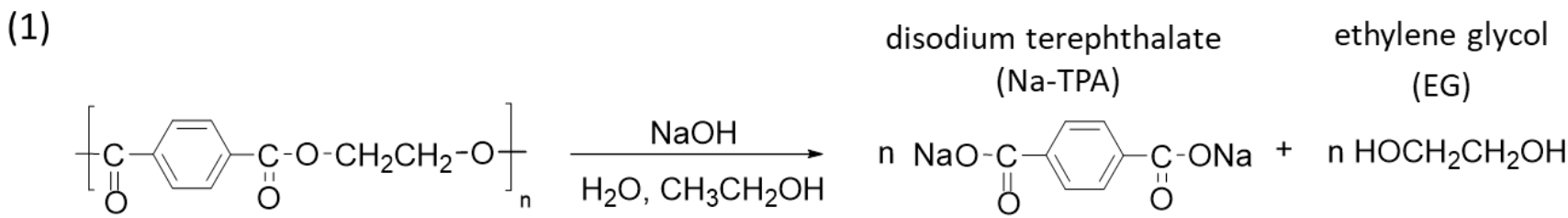
Quantification of delamination via FT-IR



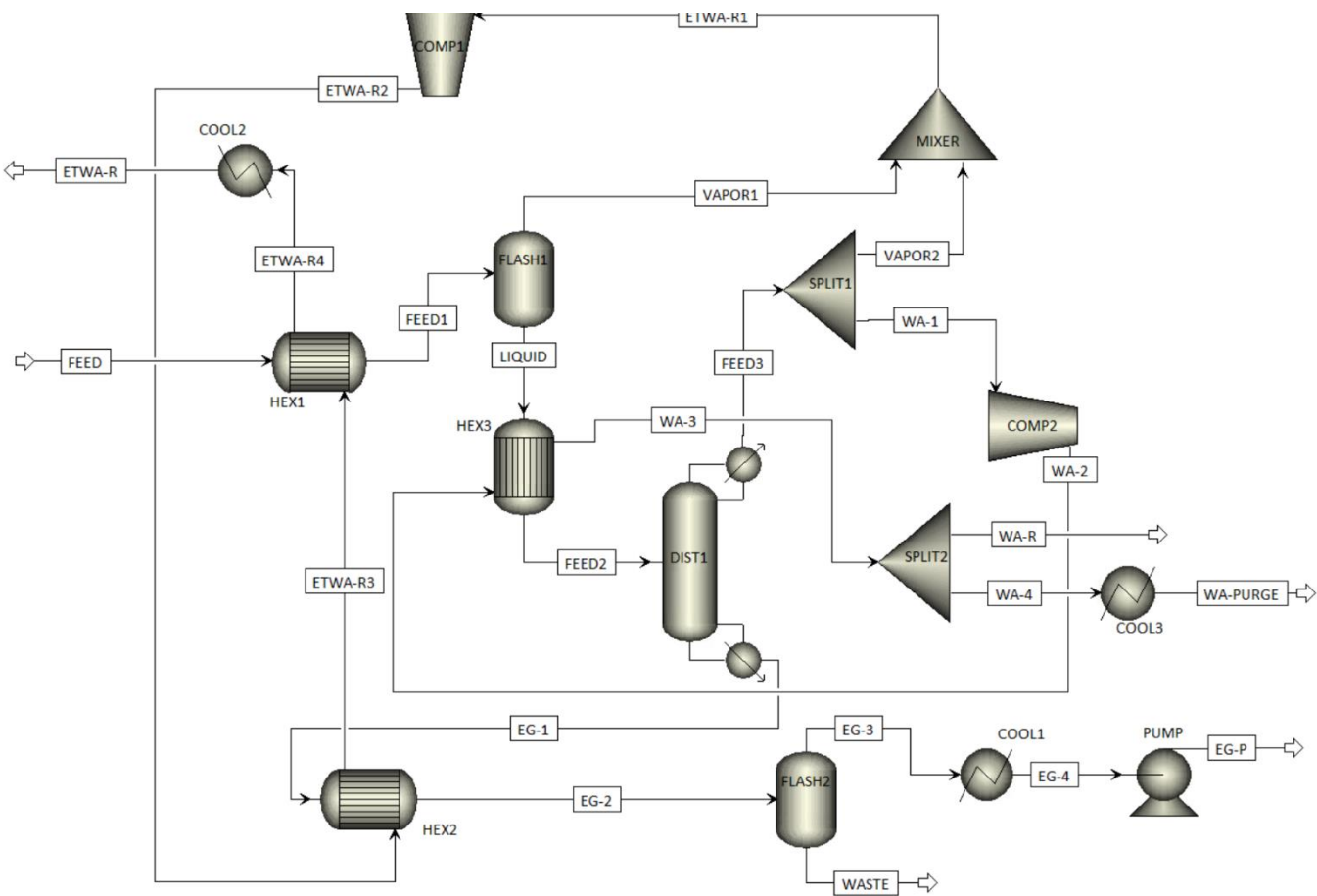
Process optimization

- S/L ratio
- Particle size
- Temperature
- Shear rate...

SELECTIVE HYDROLYSIS



Type of PET	Thickness (mm)	Specific surface area (m ² /g)	Crystallinity (%)
multilayer tray	0,35	0.0025	7.26
multilayer film	0,045	0.0192	12.49
bottle	0,27	0.0062	33.15
monolayer tray	0,16	0.0052	11.73
monolayer film	0,035	0.0213	30.77
pure PET pellets	2,5	0.0003	41.28



Green Chemistry



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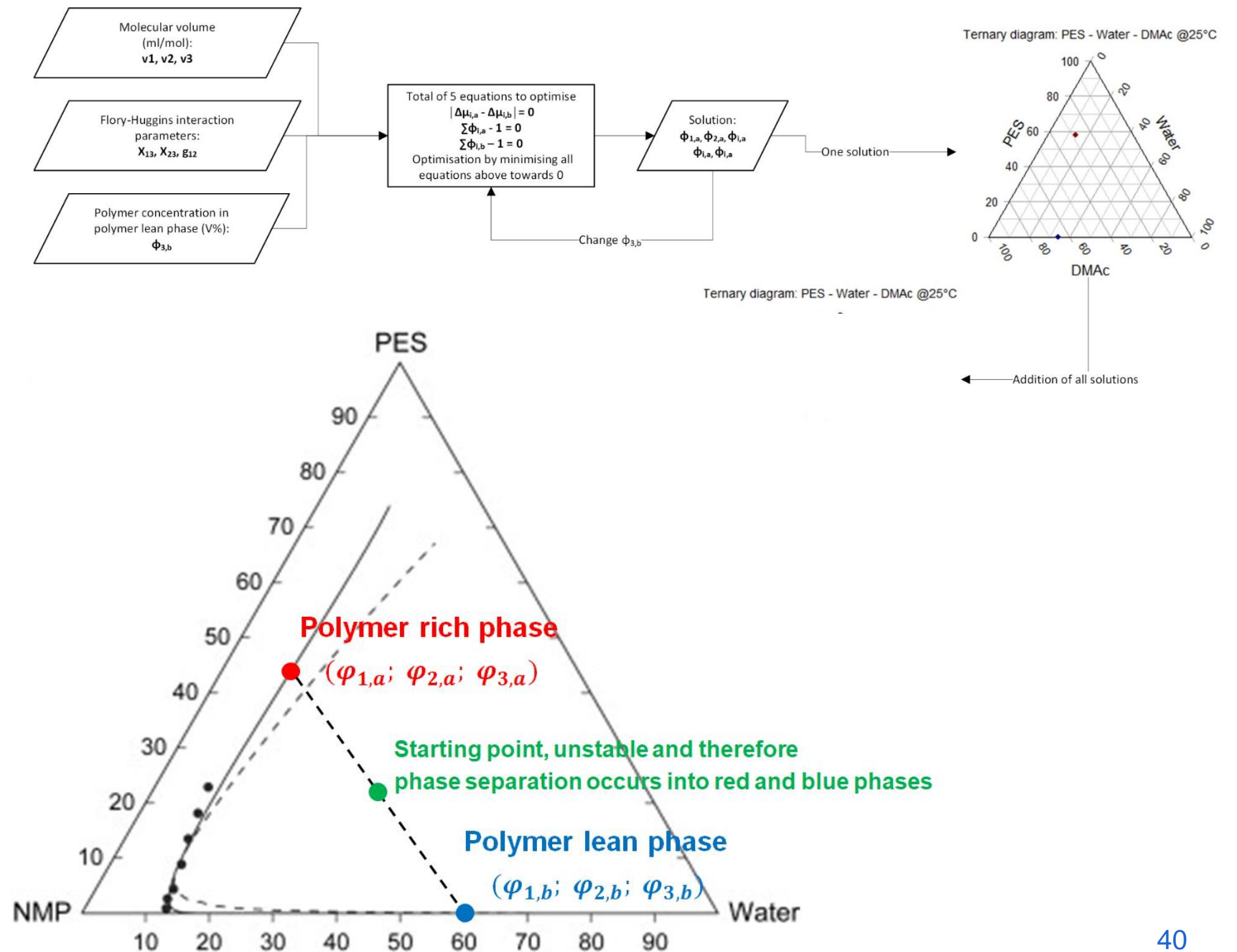
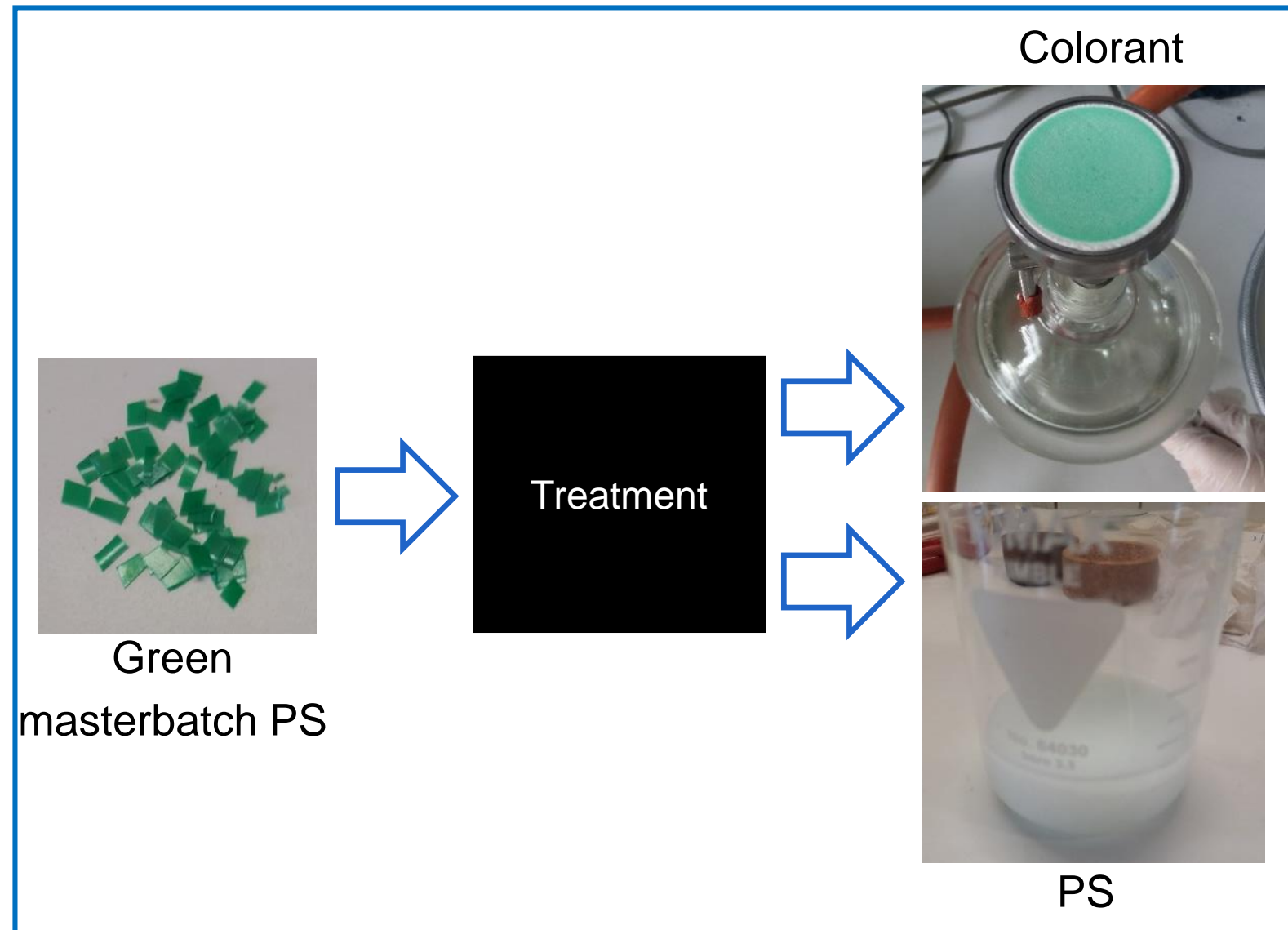


Cite this: DOI: 10.1039/d0gc00894j

Towards closed-loop recycling of multilayer and coloured PET plastic waste by alkaline hydrolysis†

Sibel Ügdüler,^a Kevin M. Van Geem,^b Ruben Denolf,^a Martijn Roosen,^a Nicolas Mys,^{a,c} Kim Ragaert^c and Steven De Meester^{*a}

Dissolution - precipitation



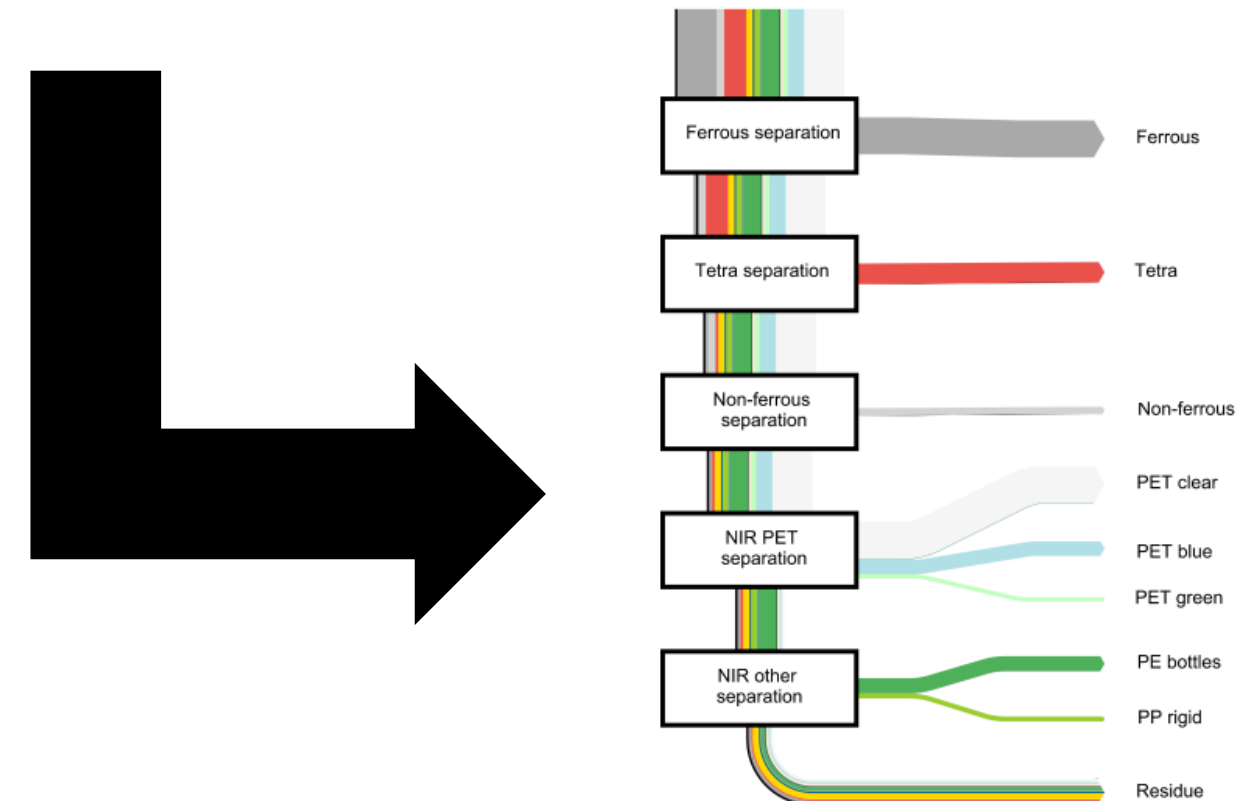
Sorting efficiencies for plastics in separation processes

		Building type		Type		Season		1st floor		2nd floor		3rd floor		4th floor		5th floor		6th floor		7th floor		8th floor		9th floor		10th floor		11th floor		12th floor		13th floor		14th floor		15th floor		16th floor		17th floor		18th floor		19th floor		20th floor		21st floor		22nd floor		23rd floor		24th floor		25th floor		26th floor		27th floor		28th floor		29th floor		30th floor		31st floor		32nd floor		33rd floor		34th floor		35th floor		36th floor		37th floor		38th floor		39th floor		40th floor		41st floor		42nd floor		43rd floor		44th floor		45th floor		46th floor		47th floor		48th floor		49th floor		50th floor		51st floor		52nd floor		53rd floor		54th floor		55th floor		56th floor		57th floor		58th floor		59th floor		60th floor		61st floor		62nd floor		63rd floor		64th floor		65th floor		66th floor		67th floor		68th floor		69th floor		70th floor		71st floor		72nd floor		73rd floor		74th floor		75th floor		76th floor		77th floor		78th floor		79th floor		80th floor		81st floor		82nd floor		83rd floor		84th floor		85th floor		86th floor		87th floor		88th floor		89th floor		90th floor		91st floor		92nd floor		93rd floor		94th floor		95th floor		96th floor		97th floor		98th floor		99th floor		100th floor		101st floor		102nd floor		103rd floor		104th floor		105th floor		106th floor		107th floor		108th floor		109th floor		110th floor		111st floor		112nd floor		113th floor		114th floor		115th floor		116th floor		117th floor		118th floor		119th floor		120th floor		121st floor		122nd floor		123rd floor		124th floor		125th floor		126th floor		127th floor		128th floor		129th floor		130th floor		131st floor		132nd floor		133th floor		134th floor		135th floor		136th floor		137th floor		138th floor		139th floor		140th floor		141st floor		142nd floor		143th floor		144th floor		145th floor		146th floor		147th floor		148th floor		149th floor		150th floor		151st floor		152nd floor		153th floor		154th floor		155th floor		156th floor		157th floor		158th floor		159th floor		160th 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floor		931st floor		932nd floor		933th floor		934th floor		935th floor		936th floor		937th floor		938th floor		939th floor		940th floor		941st floor		942nd floor		943th floor		944th floor		945th floor		946th floor		947th floor		948th floor		949th floor		950th floor		951st floor		952nd floor		953th floor		954th floor		955th floor		956th floor		957th floor		958th floor	
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- Puzzle the flowsheet together based on sorting efficiencies
- Input-Output calculations

$$f^m = (I - (Q^m)^T) * \mu^m$$
- Cross contamination matrix

$$f^m = (I - (Q^m)^T) * \mu^m$$



OVERVIEW OF PROJECTS

<p>COOCK Circopack (2019 - 2022)</p> <p>CIRCOPACK</p> <p>Future packaging policy for the circular economy Contact: prof. Steven De Meester (e-mail)</p>	<p>Marie Curie EJD: C-Planet (2020-2024)</p> <p> C-PlaNeT CIRCULAR PLASTICS NETWORK FOR TRAINING</p> <p>Circular economy for plastic Contact: prof. Steven De Meester (e-mail)</p>	<p>Catalisti ICON MATTER (2018-2020)</p> <p> MATTER Mechanical and Thermochemical Recycling of mixed plastic waste</p> <p>Mechanical and Thermochemical Recycling of Mixed Plastic Waste Contact: Nicolas Mys (e-mail)</p>	<p>Catalisti ICON P2PC (2019-2022)</p> <p>P2PC Plastic to Precious Chemicals</p> <p>Pyrolysis of waste plastics Contact: prof. Steven De Meester (e-mail)</p>	<p>Baekeland Oleon (2017-2021)</p> <p> Vlaanderen verbeelding werkt</p> <p>Renewable raw materials in the oleochemical industry Contact: Pieter Nachtergaele (e-mail)</p>	<p>BOF project: Natural dyes from food waste (2017-2021)</p> <p></p> <p>Contact: Kim Phan (e-mail)</p>	<p>ITN AGREFINE (2020-2024)</p> <p>ITN AGREFINE</p> <p>New raw material from agricultural residues Contact: prof. Steven De Meester (e-mail)</p>	<p>INTERREG ALPO (2017-2020)</p> <p> Interreg France-Wallonie-Vlaanderen</p> <p>GoToS3 ALPO New polymer-based materials from microalgae Contact: prof. Steven De Meester (e-mail)</p>
<p>INTERREG PlastiCity (2019-2022)</p> <p> Interreg 2 Seas Mers Zeeën PlastiCity European Regional Development Fund</p> <p>Industrial and commercial plastic waste recycling in urban environments Contact: Kerstin Kleinhans (e-mail)</p>	<p>Catalisti ICON PROFIT (2017-2020)</p> <p> PRIFIT</p> <p>Plastic recuperation and valorisation fit for use Contact: Ruben Demets (e-mail)</p>	<p>INTERREG PSYCHE (2018-2022)</p> <p> Interreg France-Wallonie-Vlaanderen</p> <p>PSYCHE Conversion of plastic waste to basic chemicals via gasification Contact: Sibel Ügdüler (e-mail)</p>	<p>SBO Solvation (2019-2023)</p> <p></p> <p>Separate polymers from their additives through a dissolution/swelling and precipitation process Contact: Ruben Denolf (e-mail)</p>	<p>VLIR: food and textile waste recycling in Kenya (2018-2021)</p> <p> vliruos SHARING MINDS, CHANGING LIVES</p> <p>Natural dyes from nut waste Contact: Benson Dulo (e-mail)</p>			
<p>Macerate (2020-2021)</p> <p>MACERATE</p> <p>Delamination and deinking of plastic waste: a game-changer towards closed-loop plastic recycling Contact: Martijn Roosen (e-mail)</p>	<p>Vlaanderen Circulair (2018-2022)</p> <p> VLAANDEREN CIRCULAIR</p> <p>Indicators for the circularity of products Contact: Gustavo Moraga (e-mail)</p>	<p>SBO WATCH (2019-2023)</p> <p> WATCH</p> <p>New disruptive technology for the conversion of plastic waste to chemicals via catalytic fast pyrolysis Contact: Martin Skelton (e-mail)</p>	<p>H2020 REACT (2019-2022)</p> <p> REACT</p> <p>Managing the waste acrylic textiles Contact: Brecht Tomme (e-mail)</p>				

Prof. Dr. Ir. Steven De Meester

DEPARTMENT OF GREEN CHEMISTRY
AND TECHNOLOGY

E Steven.demeester@ugent.be
T +32 (0) 56 241236
F +32 (0) 56 241224

www.lcpe.ugent.be



Ghent University



@ugent



Ghent University

THE CENTRE FOR SUSTAINABLE DEVELOPMENT

A BRIEF PRESENTATION

Prof. dr. Erik Paredis

THE CSD IN BRIEF

- Founded in 1995
- Research group of the **Department of Political Sciences** (UGent)
- **Multidisciplinary** research centre (but transdisciplinarity is a key aspect)
- 2 associate professors (and soon 3) and +/- 20 researchers

Sustainable Cities



Science, Technology and Politics



Indicators, Assessments and Monitoring



Sustainability Education



Transitions and Future Studies

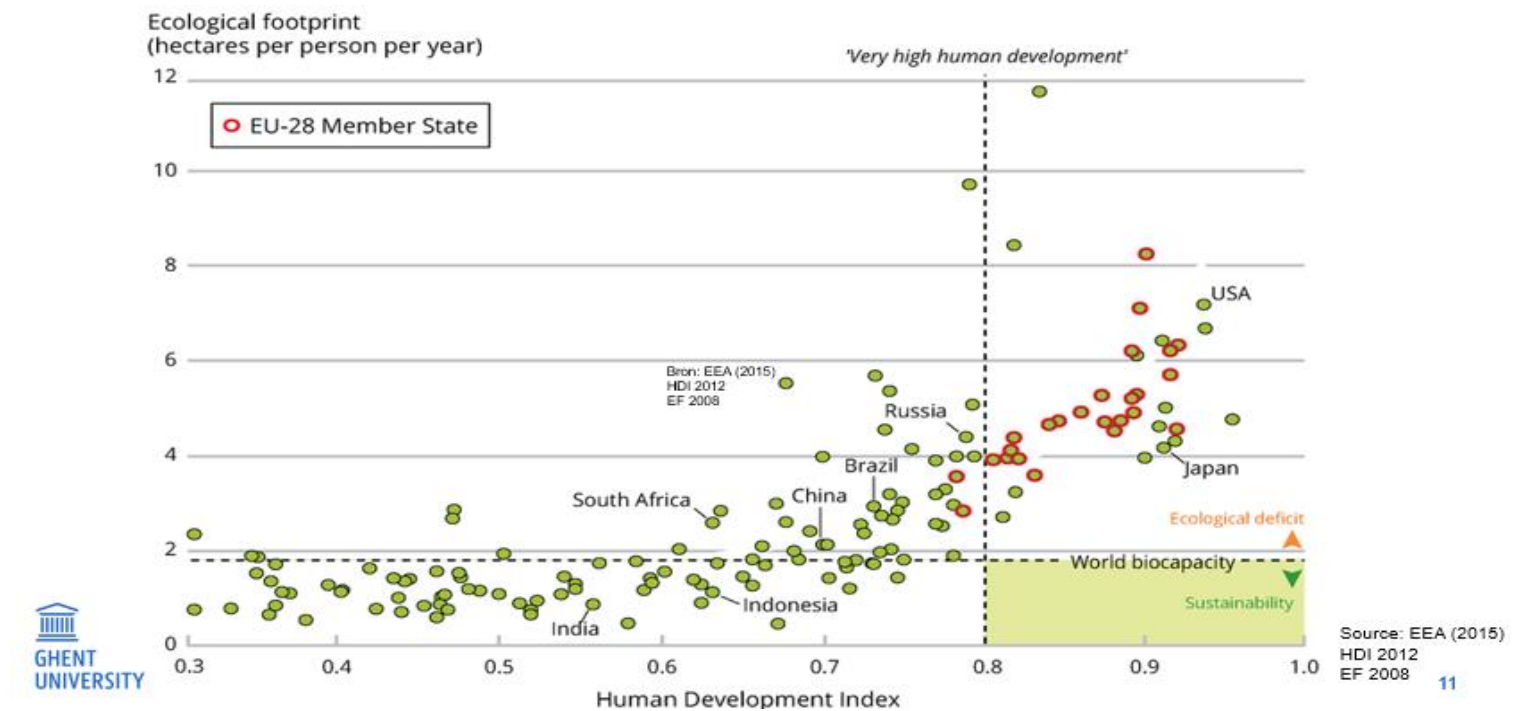


Website:
www.cdo.UGent.be

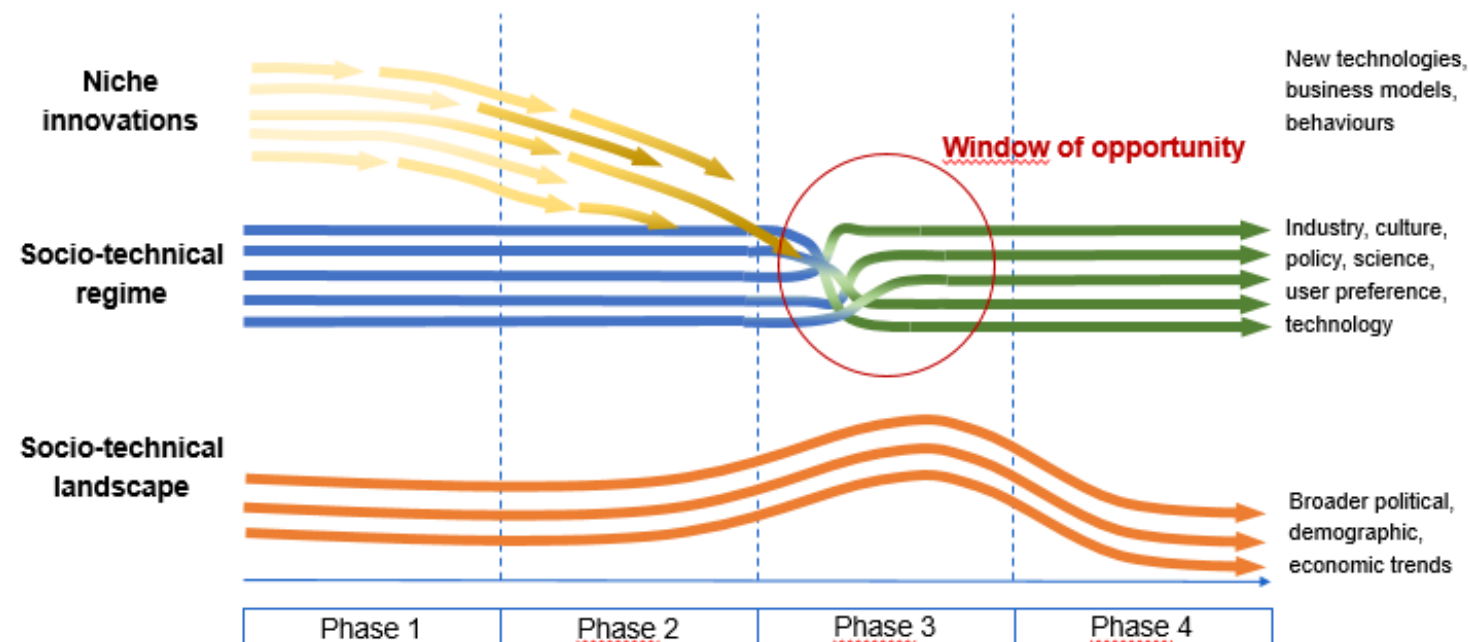
MAIN ELEMENTS OF OUR APPROACH (1)

- Normative background: **the search for a more sustainable society**: quality of life, justice, ecological limits, democracy, inter- and intragenerational

THE STATE OF THE WORLD VS. SUSTAINABLE DEVELOPMENT



Transitions: A Multi-Level Perspective (MLP)



After Geels et al. Science 2017;357:1242-1244: Sociotechnical Transitions for Deep Decarbonization

5/23

- Sustainability Transition studies**: Why is socio-technical system change needed (energy, mobility, agrofood...)? How do systems change? What is the role of niches? How do regimes resist?

MAIN ELEMENTS OF OUR APPROACH (2)

- **Critical, interpretive policy analysis:** who gets what, why and how? What is the role of power and interests, interpretation, discourse? Who wins, who loses? What are implications for governance?



- **Science and technology studies:** how do technology, science and society interact and shape each other? How and why do technology developers make choices? What are the consequences?

RESEARCH IN CIRCULAR ECONOMY

- This is one of our first research project about plastics
- But we have a series of **projects about the societal and political implications of the circular economy:**
 - Resource, product and energy recovery from wastewater: the politics of the circular economy in wastewater systems
 - Socio-technical politics of industrial transformation (CCU, hydrogen, synfuels...)
 - Socio-technical niche analysis of smart sorting technologies for end-of-life polyurethane (PU)
 - The role of product-service combinations in the circular economy (b-to-b and b-to-c)
 - The role of care and repair in the CE transition
 - Regional and spatial dynamics of the CE transition



• What is the role of design (and designers) in the transition towards more sustainable futures?

OUR ROLE IN C-PLANET

- Promotor and host for ESR 13 (Nur Gizem Yalcin): “Politics and governance in a circular plastics economy”
- Promotor and co-host for ESR 5 (Fernando Lit): “New strategies and business models for a circular plastics transition”

Erik Paredis

Associate Professor

Centre for Sustainable Development
DEPARTMENT OF POLITICAL SCIENCES

E Erik.Paredis@UGent.be
T +32 9 264 82 14
M +32 491 90 20 03

www.cdo.ugent.be



Ghent University



@ugent



Ghent University

RESEARCH UNIT

PACKAGING TECHNOLOGY

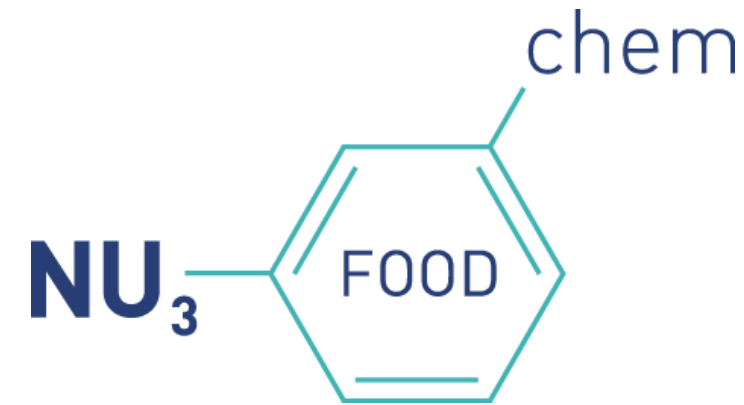
Prof. dr. ir. Peter Ragaert

RESEARCH UNIT: PACKAGING TECHNOLOGY

- Close collaboration in the department Food Technology, Safety and Health with



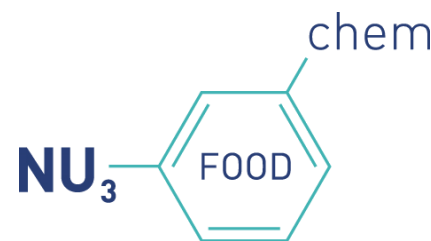
Prof. dr. ir. Frank Devlieghere



Prof. dr. ir. Bruno De Meulenaer

PACKAGING TECHNOLOGY

- Research on relation between **packaging requirements** and **shelf-life** (food quality and food safety,) focussing on:
 - Biobased and recycled plastics
 - Active and intelligent packaging
 - Antimicrobial packaging
 - Sensors to monitor shelf-life
 - New barrier materials (e.g. coatings)



EXPERTISE/INFRASTRUCTURE ON PACKAGING

- Packaging experiments with food products in different conventional, biobased & recycled packaging
- Measuring/modelling O₂-concentrations in packages
- Analysis of volatile organic components (VOC's) in relation to packaging configuration
- Relation between gas composition in headspace and microbial / chemical processes in food

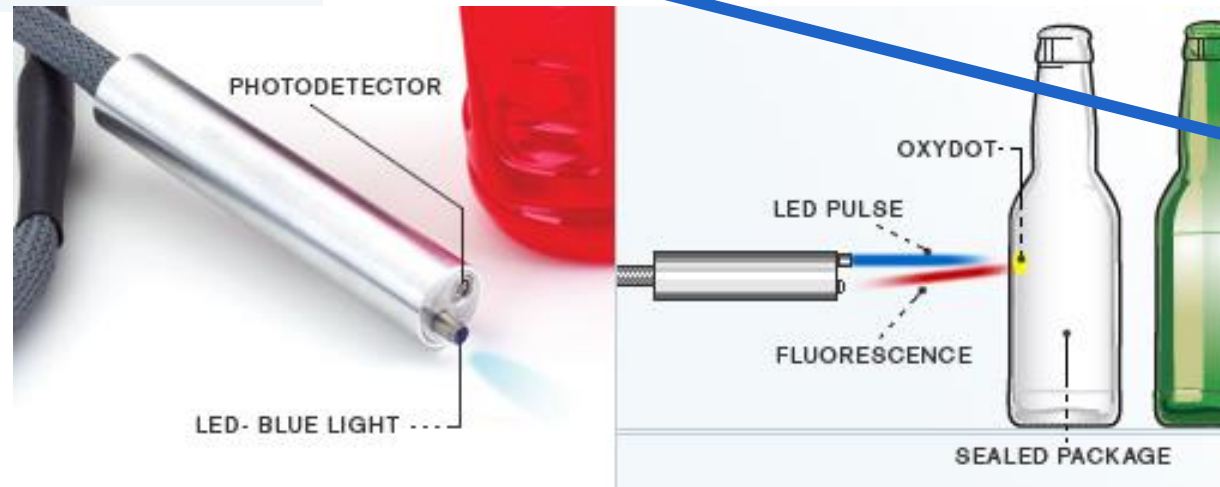
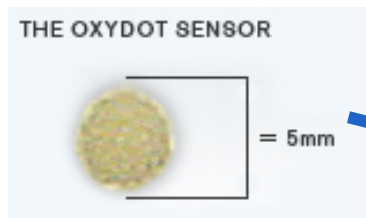
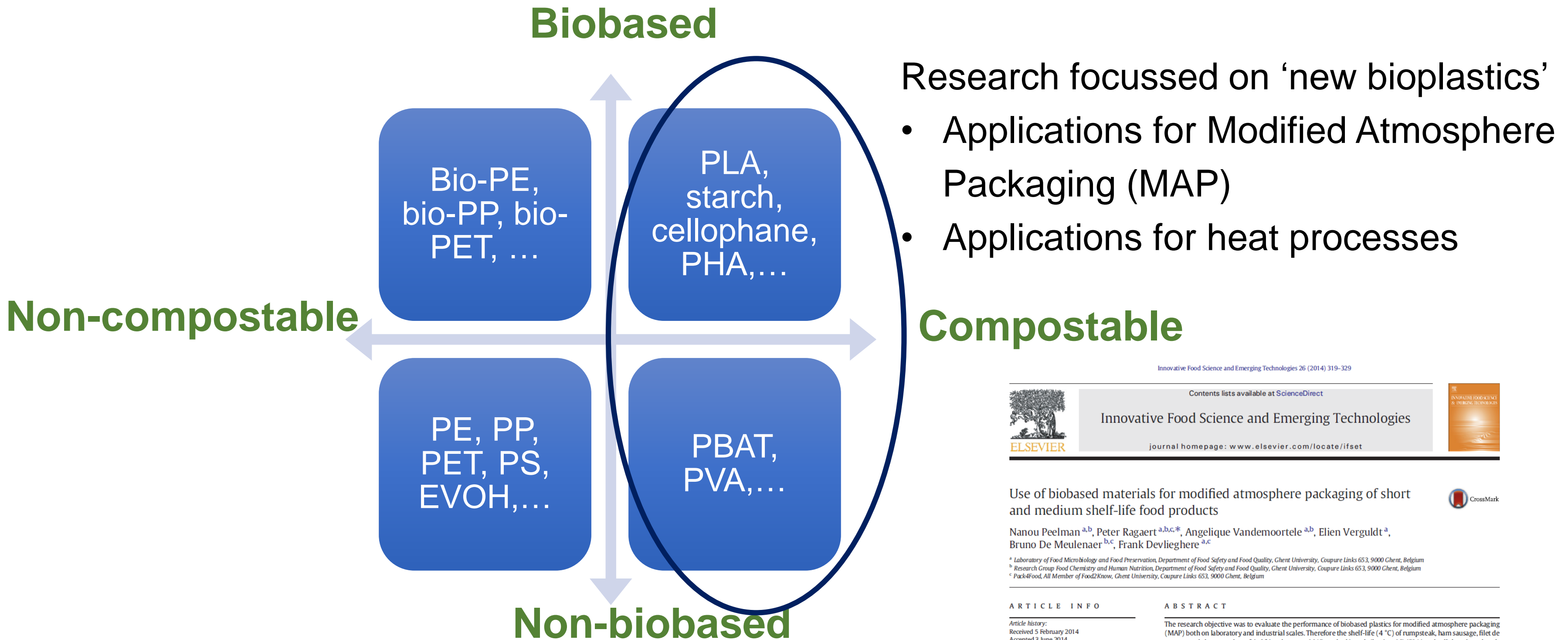


Photo: OxySense chem

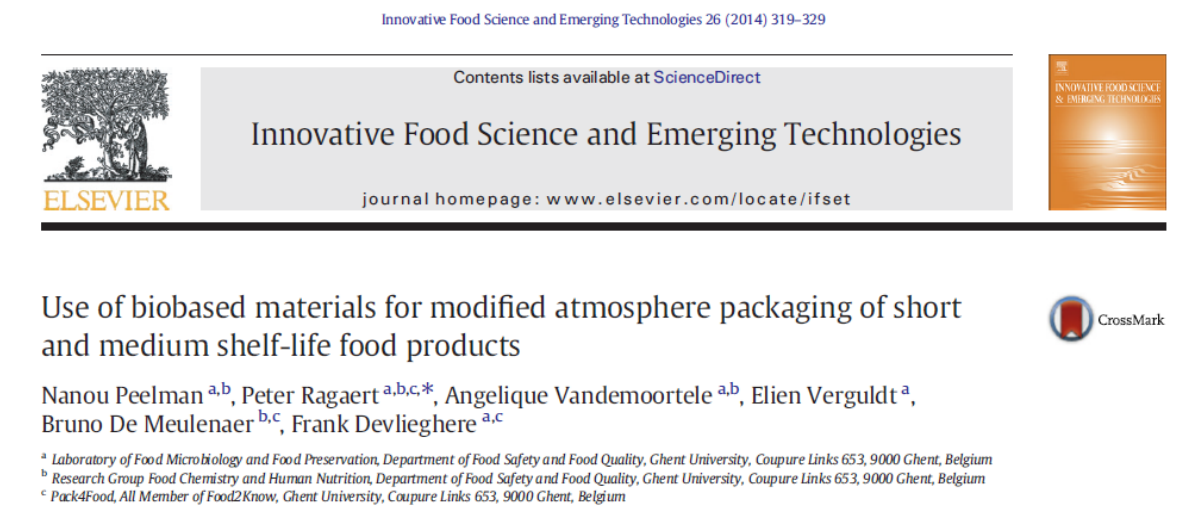


PROJECTS ON BIOPLASTICS IN FOOD PACKAGING



Research focussed on 'new bioplastics'

- Applications for Modified Atmosphere Packaging (MAP)
- Applications for heat processes



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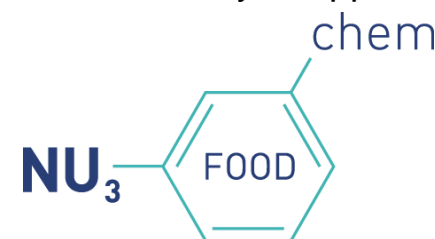
Editor Proof Received Date 14 July 2014

ABSTRACT

The research objective was to evaluate the performance of biobased plastics for modified atmosphere packaging (MAP) both on laboratory and industrial scales. Therefore the shelf-life (4 °C) of rumpsteak, ham sausage, filet de saze, grated cheese and pre-fried fries that were MAP-packed in poly(lactic acid) (PLA) and cellulose-based multilayer packages was evaluated and compared with their shelf-life when packed in conventional materials. Furthermore, tests were performed on industrial packaging lines.

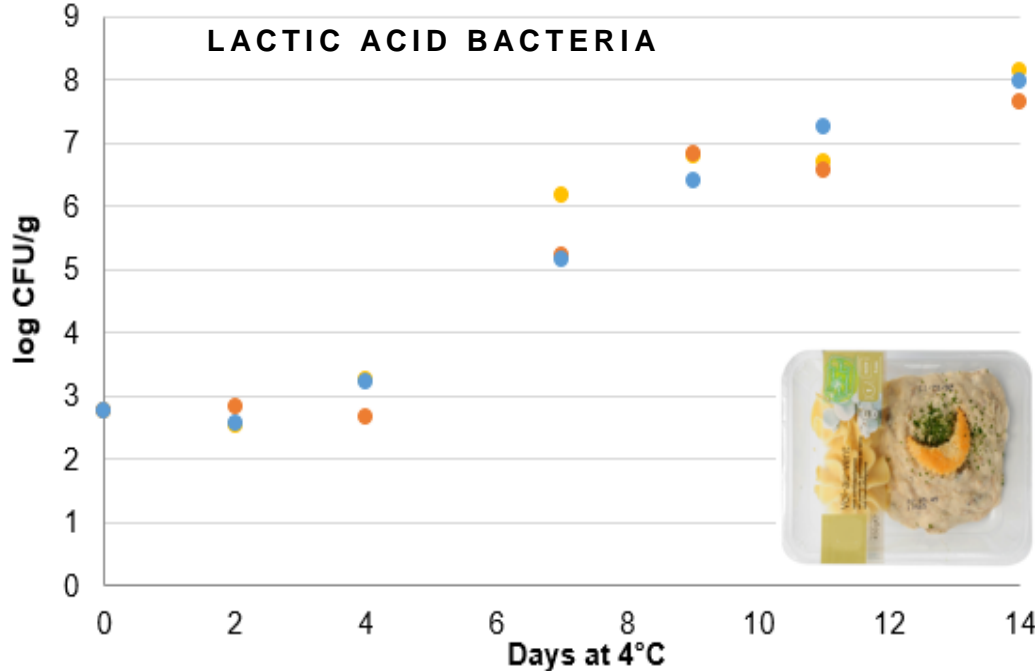
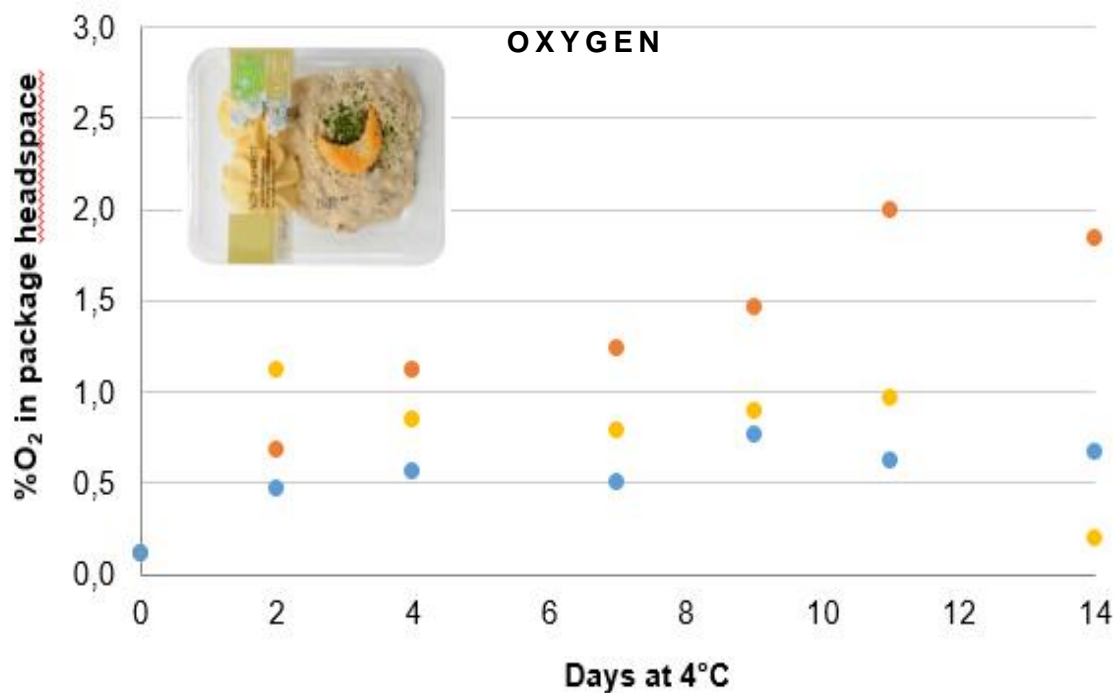
The biobased packages showed sufficient gas barrier to guarantee the shelf life of MAP packed food products.

<http://dx.doi.org/10.1016/j.ifset.2014.06.007>



OPTIBARRIER: OPTIMIZING PACKAGING CONFIGURATION

STORAGE IN DARK CONDITIONS



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RESEARCH ARTICLE

Packaging Technology and Science WILEY

Effect of packaging oxygen transmission rate on the shelf life of ready-to-heat foods susceptible to postcontamination during refrigerated and illuminated storage

Maarten Baele^{1,2} | An Vermeulen^{1,3} | Frédéric Leloup⁴ | Dimitri Adons⁵ | Roos Peeters⁵ | Frank Devlieghere¹ | Bruno De Meulenaer² | Peter Ragaert^{1,2,3}

¹Research Group Food Microbiology and Food Preservation (FMFP), Department of Food Technology, Safety and Health, Ghent University, Coupure Links 653, 9000 Ghent, Belgium

²Research Group Food Chemistry and Human Nutrition (nutriFOODchem), Department of Food Technology, Safety and Health, Ghent University, Coupure Links 653, 9000 Ghent, Belgium

³Pack4Food (Partner of Food2Know), Coupure Links 653, 9000 Ghent, Belgium

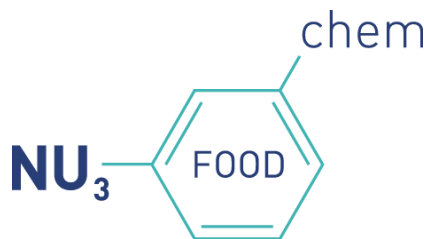
⁴Light & Lighting Laboratory, Department of Electrical Engineering (ESAT), KU Leuven, Gebroeders De Smetstraat 1, 9000 Ghent, Belgium

⁵Hasselt University, Packaging Technology Center IMO-IMOMEC, Wetenschapspark 27, Diepenbeek, Belgium

Correspondence
Peter Ragaert, Research Group Food

Since more and more pressure is exerted to reduce the use of plastic packaging materials, optimizing the use of food packaging is opportune. The aim of this study was to evaluate the combined effect of packaging materials, spanning a range of oxygen transmission rates (OTR), and retail illumination, on the microbial shelf life and safety of refrigerated ready-to-heat foods. Cooked potato slices were packaged in OPA/PP bags with a high OTR (28.85 ccO₂/m²/d) and OPA-EVOH/PP bags with a low OTR (6.57 ccO₂/m²/d). Cooked composite meals were packaged in tray and foil combinations, also spanning a range of OTR: PP trays (2.09 ccO₂/tray/d) with OPA/PP foils (28.85 ccO₂/m²/d), PP trays with OPA-EVOH/PP (6.57 ccO₂/m²/d) foils, and PET trays (0.07 ccO₂/tray/d) with PET top foil (32.86 ccO₂/m²/d). The packages were stored in a dark environment, or under fluorescent or LED light. Due to the rapid growth of lactic acid bacteria, the microbial shelf life of both food products was largely unaffected by the type of barrier. Illumination at 1000 lux for 12 hours per day led to temperature differences significantly affecting microbial growth. Based on the results, it could be concluded that re-evaluating packaging material choices for

Top foil
Tray
O₂ Barrier



Research Unit Packaging Technology

DEPARTMENT FOOD TECHNOLOGY,
SAFETY AND HEALTH

Campus Coupure, block B
Coupure Links 653
B-9000 Ghent
+32 9 264 99 30

Peter.Ragaert@UGent.be



Ghent University



@ugent



Ghent University