



PLASTICS: think global, think circular, re-think end-of-life!

Workshop on Plastics
Book of Abstracts September 24, 2020



FUR4
Sustain

European network of FURan based chemicals
and materials FOR a Sustainable development



 Funded by the Horizon 2020 Framework Programme
of the European Union

Cost Action CA18220



universidade de aveiro
theoria poiesis praxis

Editorial de boas vindas

Welcome editorial



Polymers' waste – and now what? Fossil-based polymers – and now what? Edible feedstocks, land, water? Recycling or not recycling polymers? How? Biodegradable or not biodegradable polymers?

These are some of the questions we want to re-think in this workshop dedicated to polymers end-of-life and sustainability; and above all to boost a change in the Plastic Industry, and to strengthen the European bioplastic industry. Precisely the times we are living today, with the COVID-19 outbreak, challenge us precisely to re-think plastics' end-life. For example, with the huge amount of polymers waste generated by Personal protective equipment!?

We all know that the availability of recycled polymer materials is limited and to **assure the targets set under the Circular Economy Program, the installed capacity of the European plastic industry will need to be increased.** Additional to the need of increasing the capacity in Mechanical Recycling, we are assisting today to the emerging of regenerative technologies, with the aim to add alternative solutions to plastic waste that has no efficient recycling streams.

Recycling is also being pushed, more recently, by the EU under the framework of the **'Economic Recovery Program for Europe'** by planning the application of a **tax to non-recyclable plastic** that will be put in force at national level by EU state members.

Concomitantly, brands are making sustainability commitments by using more sustainable materials, including the use of biopolymers made from renewable feedstocks; and, in some way, biodegradables are a growing part as well of the plastic industry.

Several initiatives to promote sustainable polymers have emerged in the last years. We want to highlight here the **COST Action – FUR4Sustain (CA18220)** aiming to create synergies within different actors of the **renewable-based furans value chain** to put furan chemicals and polymers and materials thereof into market; overcoming scientific, technological and industrial limitations for the achievement of more sustainable options for plastics, renewable, competitive and with optional end-of-life, as recyclability and biodegradation.

We believe that the content of the following presentations will provide you a detailed insight into polymers future through their renewability, recycling (and technology) and biodegradation prospects, re-thinking together their circularity and end-life.

Some final words to thank our speakers, Gert-Jan M. Gruter, Mark Foreman, Milena Parnigoni, and Nuno Aguiar for accepting sharing their knowledge on the field, and above all for their contribute to the circular economy and sustainability of polymers! We also want to acknowledge the University of Aveiro and the Chemistry Department for the support on the organisation of this Workshop.

Maria Eugénia Zacarias & Andreia F. Sousa



Cost Action CA18220

WORKSHOP ON PLASTICS

Book of Abstracts September 2020



Invited Speakers

Mark Foreman, Chalmers University of Technology, Gothenburg, SWEDEN
Milena Parnigoni, Strategic Development and I&D of Ecoibéria, PORTUGAL
Nuno Aguiar, APIP (Portuguese Plastic Industry Association), PORTUGAL
Gert-Jan M. Gruter, Avantium Chemicals, Amsterdam, THE NETHERLANDS

Organising Committee

Andreia F. Sousa, CICECO and Chemistry Dep./University of Aveiro, PORTUGAL
Maria Zacarias, LOGOPLASTE INNOVATION LAB, PORTUGAL

Prof dr Gert-Jan M. Gruter

University of Amsterdam
CTO Avantium



Gert-Jan (1963) has a background in Polymer Chemistry (DSM 1993-2000) and has been Professor of Polymer Catalysis at Eindhoven University of Technology.

In 2000 he transferred to Avantium and in 2004 he was appointed as Chief Technology Officer (CTO). He initiated the YXY technology which includes novel processes from carbohydrates to FDCA monomer and 100% bio-

based PEF polyester for bottles, fibers and film. In addition Gruter is involved in the development of the “DAWN Biorefinery Technology” for the production of pure glucose from agro and forestry lignocellulosic residues, the “RAY bio-MEG Technology” for the 1-step hydrogenolysis of sugars to Mono Ethylene Glycol and the “Volta Technology” for the electrochemical reduction of CO₂ to formate and subsequent steps to polyester monomers such as oxalic acid and glycolic acid.

Gert-Jan is inventor on more than 100 patents; he was elected “2014 European CTO of the year” and runner-up European inventor of the year in 2017. Gert-Jan is currently part-time professor Industrial Sustainable Chemistry at the University of Amsterdam (UvA), where he is working on novel high T_g sustainable polyesters for re-use, polyester biodegradation, chemical recycling, consumer psychology and on ocean plastics.

[a] *Industrial Sustainable Chemistry, HIMS, University of Amsterdam. PO Box 94157, 1090GD Amsterdam, The Netherlands*

[b] *Avantium Chemicals BV, Zekeringstraat 29, 1014BV Amsterdam, The Netherlands.*

g.j.gruter@uva.nl
gert-jan.gruter@avantium.com

THE FUTURE OF PLASTICS

The Opportunity of Sustainable Materials from biomass and CO₂

The future of plastics will be determined by three main factors: (1) climate change will require a transition from fossil feedstock to renewable feedstock (biomass (FDCA [1], bio-MEG), CO₂ (oxalic acid, glycolic acid [2]) and (chemical) recycling are the only alternatives for fossil feedstock); (2) the 3-5% annual growth of polymer materials will lead by 2050 to a tripling of the 350 million tons of plastics produced in 2018, which creates a feedstock challenge as well as a feedstock opportunity. We need to reduce, reuse and recycle; (3) the 8 million tons of plastics leaking into the environment every year may overtake climate change as the #1 challenge of humanity in the coming decades. In the presentation some of the Avantium and UvA developments that will address these three main factors will be presented.

References

[1] A.F. Sousa, C. Vilela, A.C. Fonseca, M. Matos, C.S.R. Freire, G.J.M. Gruter, J.F.J. Coelho, A.J.D. Silvestre *Polym Chem* 2015, 6, 5961.

[2] (a) M.A. Murcia Valderrama, R.J. van Putten, G.J.M. Gruter *Eur Pol J* 2019, 119, 445; (b) M.A. Murcia Valderrama, R.J. van Putten, G.J.M. Gruter *ACS Appl Pol Mat* 2020, 2, 2706



FUR4
Sustain

Workshop PLASTICS: think global, think circular, re-think end-of-life!
September 24, 2020

Foreman Mark Russell StJohn

Chalmers University of Technology
Gothenburg, SWEDEN



Mark Foreman is a chemist who is an associate professor at Chalmers University of Technology, he works both in the Nuclear Chemistry and Industrial Materials Recycling units there. He obtained his first degree from Imperial College (Specializing in organic chemistry) and his PhD from the University of

Loughborough (Organo phosphorus sulfur chemistry) before working as a postdoc on a range of topics.

Since becoming an academic his interests have included the solvent extraction of metals, waste water treatment, nuclear reactor chemistry, new more sustainable reagents (including deep eutectic solvents), radioactive waste disposal and the recycling of organic materials. The recycling of organic materials includes the recycling of plastics and polymers, Mark has been working in collaboration with Antal Boldizar. Together they have supervised two students to PhD level on the recycling of plastic from waste electronic and electrical equipment.

Foreman@chalmers.se

RECYCLING OF PLASTICS

This is a talk about the recycling of plastics, in this talk the nature of plastic waste, some of the challenges and some of the methods for the recycling of plastics will be discussed.

References

Mark R.StJ. Foremana,*
[a] Industrial Materials Recycling, Department of Chemistry and Chemical Engineering, Chalmers University of Technology, Göteborg, Sweden.



FUR4
Sustain

Workshop PLASTICS: think global, think circular, re-think end-of-life!
September 24, 2020

Milena Parnigoni

Ecoiberia Reciclados Ibéricos SA



In 2005, when she moved from Italy to Portugal, she co-founded Ecoiberia in a 3 x 4 mt2 warehouse. Nowadays Ecoiberia SA is the biggest Pet recycler in Portugal, processing about 45.000 tons of Pet waste every year.

As Strategic Development Manager at the company, she has recently cut for herself the position which she likes most: see “what’s next”. I&D Projects she leads include valorisation of Pet recycling sub-products by injection, Trays to Trays circular process, Flakes to Preforms, Design4Recycling.

Ecoiberia Reciclados Ibéricos SA
 Trav. Sebastião Fernandes 60
 4760-706 – Ribeirão – V. N. de Famalicão - PORTUGAL
 milena.parnigoni@ecoiberia.pt

PET AND PET+PEF RECYCLING.

Is PEF such a good idea?

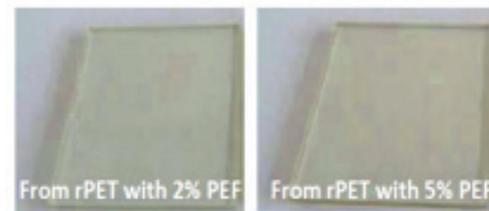


Figure 1
 Plaque According To Eppb

In 2020, PEF packaging has not yet entered the European market: but, in the next future, will “the sleeping giant” be another Bio-based resin that plastic recyclers will have to deal with and hate, or will it be an opportunity for Pet plastic recyclers as well?

What do we “supposedly” know about this new resin recycling? That PEF is for sure to be considered as a contaminant to quality r-PET stream. PEF packaging can be identified at sorting stream centres using current optical sorting methods and thus separated from other plastics: good! But without optical sorting, it is impossible to distinguish between PEF and PET packaging. All sorting centres should be equipped with optical sorting when PEF packaging enters the market. And the process applied by PET recyclers should ensure that any remaining PEF is eliminated so that levels are considerably lower than the 2% threshold specified by EPBP.

But once the tonnage of PEF on the market begins to rise, PEF packaging will have to be directed towards a specific with a view to starting R&D work on uses of recycled PEF. As part of the polyester family, PEF could be recycled in streams like those used for PET, i.e. fibres, mechanical recycling as packaging, as well as chemical recycling. But it will require a dedicated collection-sorting stream.

Well: another dedicated recycling stream, when not everywhere in Europe even Pet trays or PP or PS are collected in a dedicated stream? What would be ideal: to go 100% circular with Pet bottles or fully aim at substituting part of the Pet consumption with PEF? Shall PEF in view of its properties, be dedicated only to package sensitive products requiring a gas or moisture barrier and replace current multi-material packaging (e.g. PET/PA or HDPE/EVOH composite packaging used for sparkling water or fruit juice)? In view of the projected costs, it really seems this will be the future most probable market for PEF. If so, what shall Pet recyclers decide: is PEF the next enemy or the next opportunity?



FUR4
 Sustain

Workshop PLASTICS: think global, think circular, re-think end-of-life!
 September 24, 2020

Nuno Aguiar

Technical Director at APIP
Portuguese Plastics Industry Association



Nuno Aguiar has a degree in Environmental Engineering from Faculty of Science and Technology, New University of Lisbon.

He is a Plastics Recycling Specialist with 13 years of experience on the waste management, plastics recycling and plastics packaging industry. Nuno worked for 12 years at Plastval as an operations manager. Today he is the Technical Director of the Portuguese Plastics Industry Association (APIP), where he is responsible for the coordination of all technical areas.

His life has been dedicated to waste and recycling activities, namely statistical information on packaging markets, recycling rates, waste and recycles index prices and trend markets, and also training, consulting and technical support to environmental audits. Besides working in plastics management operations, Nuno was also an internal environmental certified auditor.

Portuguese Plastics Industry Association (APIP),
Ed. Libersil – Torre B | Rua S. José, 35 – 2º C,
1150-321 Lisbon, Portugal

www.linkedin.com/in/nuno-aguiar
nunoaguiar@apip.pt

PLASTICS INDUSTRY: BUILDING A CIRCULAR ECONOMY

Combining excellent functional properties plastics have radically changed our economy and society. Unfortunately, each year a lot of plastic is lost or wasted, causing unacceptable environmental and economic harm. The so-called “take, make and dispose” linear economy model is no more sustainable.

Society needs to stop thinking of plastic as waste, but as a renewable resource that needs to be disposed of correctly. Plastic is a recyclable material and a valuable resource – industry looks to it as a resource not a waste. Plastics industry is committed to be part of the solution putting its material onto a more sustainable path.

Circularity and resources efficiency challenges require that companies continually innovate in their production processes, where research and technological development are crucial to achieve these goals. In this context a cross-value chain collaboration is needed for the adoption of policies that stimulate the transition towards a true circular economy.

R&D + I projects, plastics from alternative non-fossil fuel feedstocks, waste prevention, plastic wastes as a resource; design for recyclability (Ecodesign), full Life Cycle Analyses (LCA) studies; consumer “recycling” behaviors, better and more efficiency collection, classification and recycling schemes, demand for Recycled Plastics, etc., are some of the main challenges and solutions to build a more circular economy for plastics.

The presentation will show the main challenges and actions that plastics industry is taking to address the circular economy and sustainability principles.

Keywords

Plastics, Alternative feedstocks, Circular Economy, Ecodesign, LCA, Recyclability, Recycling, Recycled plastics



FUR4
Sustain

Workshop PLASTICS: think global, think circular, re-think end-of-life!
September 24, 2020

PLASTICS: think global, think circular, re-think end-of-life!

Workshop on Plastics
Book of Abstracts September 24, 2020



FUR4
Sustain

European network of FURan based chemicals
and materials FOR a Sustainable development



cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY



Funded by the Horizon 2020 Framework Programme
of the European Union

Cost Action CA18220



universidade de aveiro
theoria poesis praxis