DPI: Quo Vadis?

Annual Report 2018

DPI
The Polymer
Research Platform

Foreword
DPI: Quo Vadis?

DPI TEAM
Rosanne Peters, Leon Damen, Jacques Joosten, Peter Kuppens, Christianne Scharff, Jan Smook, Ronald Korstanje, Linda de Wit, Renée Hoogers, Denka Hristova-Bogaerds, Jeanne van Asperdt, Thomas Manders and Jan Stamhuis.
Arie Brouwer is absent in this picture

Following the uncertainty of the past few years, 2018 marked a decisive turning point for DPI. In August, the Supervisory Board unanimously and definitively declared its faith in DPI as a unique and viable international collaboration platform for polymer research. Our efforts to reinvigorate DPI continue unabated.

The basic concept of DPI remains unchanged. Industry is the prime backer of DPI and remains in the lead when it comes to choosing research topics. Our core activity continues to be the technology-oriented research programmes defined in conjunction with our industrial partners and addressing challenges that companies cannot or do not wish to deal with individually. In addition, value-chain projects are undertaken as and when required by our partners, for example within the framework of EU programmes. A strong point is the virtual nature of the DPI platform, enabling a choice of the best available competences from research groups across the world.

Partners and projects
In 2018, we were happy to welcome two new industrial partners. This brings the total number of participations in the current DPI core programme to 17. Although this is still below target, we are pleased to see that our efforts to attract new partners are slowly but steadily paying off. In 2018 several new projects were launched in the different programme areas: five projects in Polyolefins and two projects in Polymers for Oil and Gas. Work on projects started the year before continued as planned, as did the remaining parts of older programmes.

The CE challenge
For some time now, there has been a lot of talk discussion about a Circular Economy (CE). Is CE just a hype? A trending topic that will pass? We do not think so. There is widespread consensus globally about the need to rethink some of our processes, including our use of natural resources. The cradle-to-grave lifecycle principle is rapidly evolving into a cradle-to-cradle philosophy, in which the product design stage plays a crucial role in order to anticipate the end-of-lifecycle stage.

As the talks given by leading invited speakers during the thematic session on CE at our Annual Meeting in 2018 showed, DPI's role in bringing together industrial stakeholders is as important today as it was in the past. The same DPI concept that has in the past helped to create a strong knowledge infrastructure for polymers can now play an important role in generating the knowledge needed to address the manifold challenges faced by science, industry and society today. DPI has to examine what it should and could do in this changing setting, while continuing to adhere to its industry-defined role.

Exploratory initiatives
During the past two years, we have taken several initiatives to gauge the interest of our industrial partners in working together in the pursuit of CE for plastics and to explore if and what supportive role DPI could play. Among other things, we organised workshops targeting the polymer value chain as well as brainstorm sessions centred round specific DPI programme areas. Our partners as well as other interested players in the fields participated in these initiatives, a good example being the Polyolefins Circularity Workshop held in October. While there is general agreement that the world is faced with major problems that need to be addressed, some at the global level, there is as yet no consensus on how this should be done or who should take the initiative.

We are, of course, aware that companies are bound by operational, economic and strategic considerations and constraints that determine their priorities. This means that it is sometimes difficult for them to invest in activities that do not seem immediately relevant to their current business and short-term interests. However, we are convinced that long-term continuity of business is just as important to them. DPI has a good value proposition and we think we can

help the two goals – safeguarding short-term and long-term business interests – to converge. Whatever role DPI may play, we have the capability to track developments, both industrial and academic, and help our partners to grasp opportunities when these present themselves. In this sense, DPI is an ideal vehicle for collective and cost-effective risk sharing. Enhancing the knowledge base required for specific business activities can go hand in hand with developing new knowledge to address broader industrial and societal themes. Given the widespread use of polymeric materials in every imaginable domain, polymer research is important worldwide.

DPI's research programmes have all along helped maintain a steady supply of young scientists qualified and trained in industrially relevant areas. Increasingly, it is becoming important that young scientists should in addition have the knowledge and capabilities to play an active role in addressing the challenges faced by science, industry and society, for example in resolving the plastic waste problem.

The road ahead

We now have a better understanding of our partners' position, as well as the possibilities and limitations of the role DPI can play. We can, at any rate, proactively explore the terrain and advise our partners on promising, or even crucial, areas worth pursuing. Ultimately, it will be up to the partners – both current and new – to collectively decide if, in addition to the core programme areas, they want to take any further initiatives within the collaborative framework available. This could for example enable them to address themes that they think are or may become important and, based on their assessment of their current and future interests, also push for a stronger knowledge base in these areas at the universities.

Jacques Joosten – Managing Director

Contents

Organisation 2018

Supervisory Board

- **Dr. H.M.H. van Wechem**, *Chair*
- **J. de Jeu, MA MSc**
- **Dr. F. Kuijpers**
- **Prof. K.C.A.M. Luyben**
- **Dr. J.A. Roos**

Executive Boar

- **Dr. J.G.H. Joosten**
  Managing Director, Chair
- **Vacancy**
  Scientific Director

Programme Area Coordinators

- **Dr. D.G. Hristova-Bogaerds**
  Performance Polymers
- **R.J. Korstanje, MSc**
  Functional Polymers and Surfaces
- **Dr. J. Smook**
  Polyolefins (left in 2018)
- **Dr. J.E. Stamhuis**
  Polyolefins
  Polymers for Oil and Gas

Scientific Programme Chairs

- **Prof.dr. V. Busico**
  Polyolefins
- **Prof.dr. C. Creton**
  Performance Polymers
- **Prof.dr. D.J. Broer**
  Coatings Technology

Organisation Staff

- **A.F.J. van Asperdt**
  Financial Administration
- **L.A.W. Damen**
  Project Administration
  Financial Administration
- **R.P.F. Hoogers-Valken**
  Secretariat
- **P.J.J. Kuppens, AA**
  Controlling
- **Rosanne Peters**
  HR&O Manager
- **C.H.L.M. Scharff-Bastiaens**
  Communications
- **L. de Wit**
  Project Administration

Staff European projects

- **A. Brouwer, MSc**
  Project Manager
- **Dr. D.G. Hristova-Bogaerds**
  Project Manager EMMC-CSA
- **L. de Wit**
  EU Project Office

DPI: International Centre of Excellence in Polymers

In the last few years DPI has transformed itself into an International Centre of Excellence in Polymers. To achieve that goal, the institute has expanded its pre-competitive research programme with projects focusing on pre-commercial application themes.

Pre-competitive research programme

DPI's pre-competitive research programme currently embraces five programme areas. Companies and knowledge institutes can participate in one or more of these areas, each of which encompasses a substantial number of projects. The participating companies jointly define the programme content for the programme areas in which they participate. PhD students and post-docs from our partner knowledge institutes perform their research in close collaboration with scientists from our industrial partners. Shaping that collaboration between industry and academia is the key to building a coherent community that delivers research results to the envisaged high standard and prepares our scientists for their future careers, in industry or elsewhere.

PRE-COMPETITIVE PROGRAMME

DPI Rules & regulations apply to all projects

Polyolefins		Performance Polymers	
23 projects		**19 projects**	
Industry	**Academia**	**Industry**	**Academia**
• Borealis • Braskem • Dow Benelux • ExxonMobil • Reliance • SABIC • SCG Chemicals • Sinopec	• Eindhoven University of Technology • ESCPI-Lyon • ETH Zurich • Fraunhofer Institute for Structural Durability and System Reliability LBF • Japan Advanced Institute of Science and Technology • Leibniz-Institut für Polymerforschung Dresden • Lomonosov Moscow State University • The University of Texas at Austin • Utrecht University • University of Chemistry and Technology Prague • University of Groningen • University of Manitoba • University of Naples Federico II • University of Perugia • University of Turin	• DSM • Hutchinson • Nouryon • SABIC • Shell • SKF • Tejin Aramid	• CNRS Strasbourg • Eindhoven University of Technology • Ghent University • KU Leuven • Radboud University • The University of Manchester • University of Groningen • University of Twente
Expenditure € 1.77 million FTEs 17.9 (28 researchers)		Expenditure € 1.83 million FTEs 13.1 (20 researchers)	

Industrial pre-commercial programme

The industrial pre-commercial programme consists of Value Chain projects and EU projects. The conditions for performing Value Chain projects are described below and those for EU projects are in accordance with published EU rules that are available on the relevant websites.

The Value Chain projects offer companies and/or research institutes the opportunity to establish consortia for innovation projects, in which they collaborate within the value chain. Every partner plays an active role in the project, which must be aimed at further development of an innovation. The projects are intended to generate economic activity within the foreseeable future (i.e. no later than two to five years after completion of the project).

DPI's role is to actively assist in establishing the collaboration and to coordinate the project. DPI's role can also be limited to acting as coordinator of a project.

DPI provides a model framework for the collaboration, but the detailed rules are agreed between the members of the consortium. As regards intellectual property, the basic principle is that the knowledge created during the course of the project (foreground knowledge) is the property of the inventing partner, and any background knowledge contributed to the project remains the property of the partner that provided it. Other partners have free access to the knowledge contributed to and/or generated during the project, but only for research purposes and to the extent necessary for developments in the project. Specific agreements are made to enable access to another partner's IP for commercial application of the knowledge outside the project.

PRE-COMPETITIVE PROGRAMME

DPI Rules & regulations apply to all projects	
Coatings Technology	**Polymers for Oil and Gas**
7 projects	**3 projects**
Industry • Eindhoven University of Technology • University of Groningen • Wageningen University & Research	**Industry** • Shell • SNF Floerger
	Academia • Université de Bordeaux • University of Twente
Expenditure € 0.54 million FTEs 4 (8 researchers)	Expenditure € 0.14 million FTEs 1.8 (2 researchers)

EMMC-CSA

DPI is a partner in the project EMMC-CSA (European Materials Modelling Council – Coordination and Support Action), which comes under the EU's Horizon 2020 framework programme.

Modelling is a key pillar underpinning the development of new materials and products responding to societal needs and challenges and for ensuring competitiveness of European industry in the 21st century.

Scope

The aim of the project is to allow European Industry to reap the benefits of materials modelling more effectively and vigorously by helping to bridge the gap between academic innovation and industrial application.

The project, which was launched in September 2016 and has a duration of three years, is being carried out by a consortium of 15 partners from 10 countries and involves 5 companies and 10 Research and Technology Organisations (RTOs).

DPI's role

The tasks of DPI are related to the translation of industrial challenges into modelling solutions and the development of strategies for a wider adoption of materials modelling by industry. DPI is also represented in the EMMC Operational Management Board.

More information about the European Materials modelling council EMMC and this project can be found at:

https://emmc.info/about-emmc-csa/

Co-funded by the Horizon 2020 programme of the European Union

INDUSTRIAL PRE-COMMERCIAL PROGRAMME

Model framework for collaboration

Rules and regulations set by involved partners

EMMC-CSA
(1-9-2016/31-8-2019)

Partners

- Access e.V.
- Dow Benelux
- DPI
- Ecole Polytechnique Federale de Lausanne
- Fraunhofer IWM
- Goldbeck Consulting
- Granta Design
- Helmholtz-Zentrum Geesthacht
- Materials Design (MDS)
- Politecnico di Torino
- QuantumWise
- SINTEF
- TU Wien
- University of York
- Uppsala University

Budget €3.77 million
(€3.77 million EU subsidy)

NEWPOL (New Polymer Materials) programme

DPI is working together with NWO, the Netherlands Organisation for Scientific Research, on the NEWPOL (New Polymer Materials) programme. NEWPOL is a public-private initiative focusing on developing new polymeric materials by encouraging cross-pollination between different research fields and disciplines.

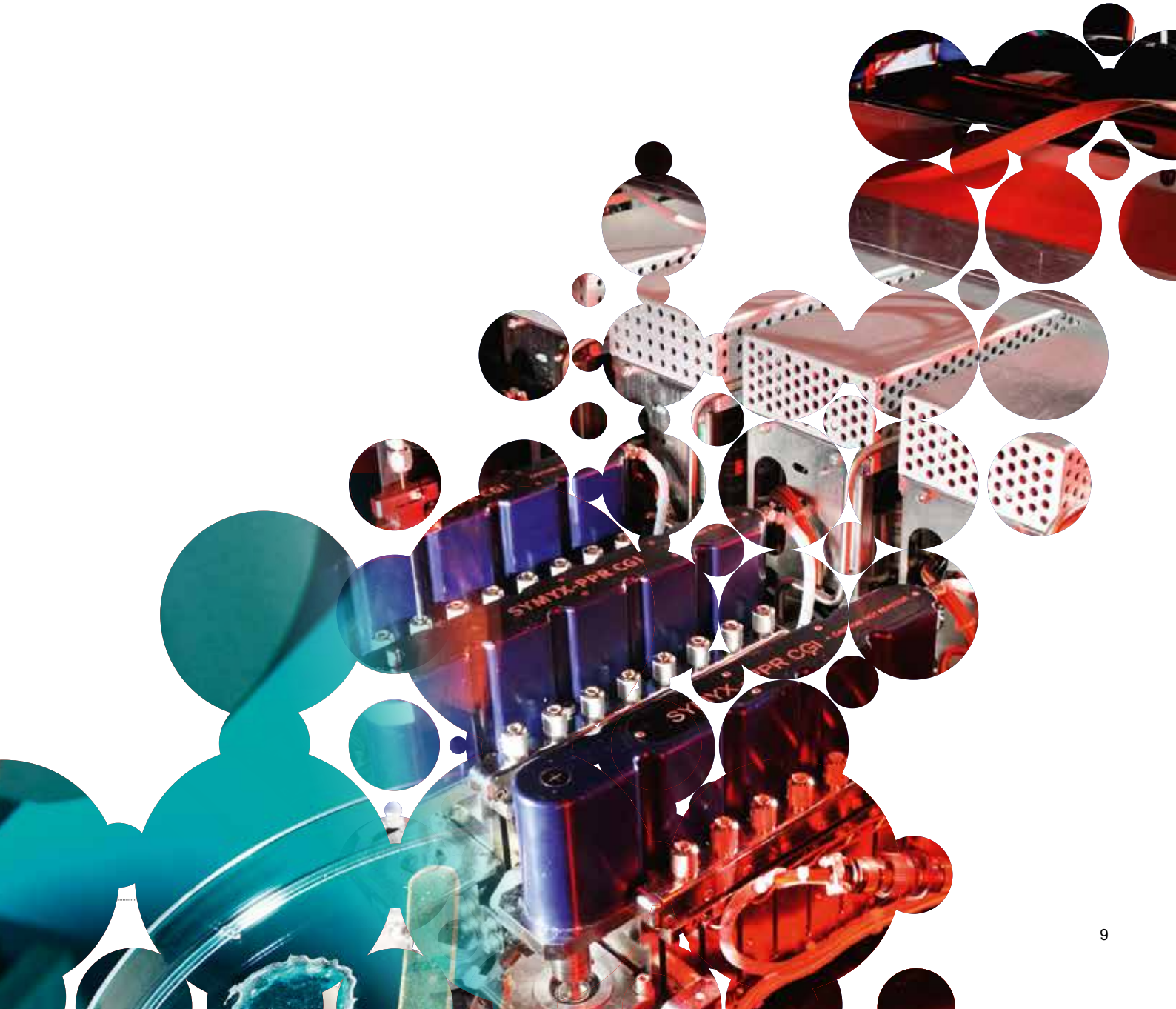
DPI has organised the NEWPOL activities as a separate programme area. The programme offers DPI a good opportunity to explore the possibilities of this model of cooperation.

All of DPI's industrial partners are participating in this programme, which encompasses six projects on topics such as:

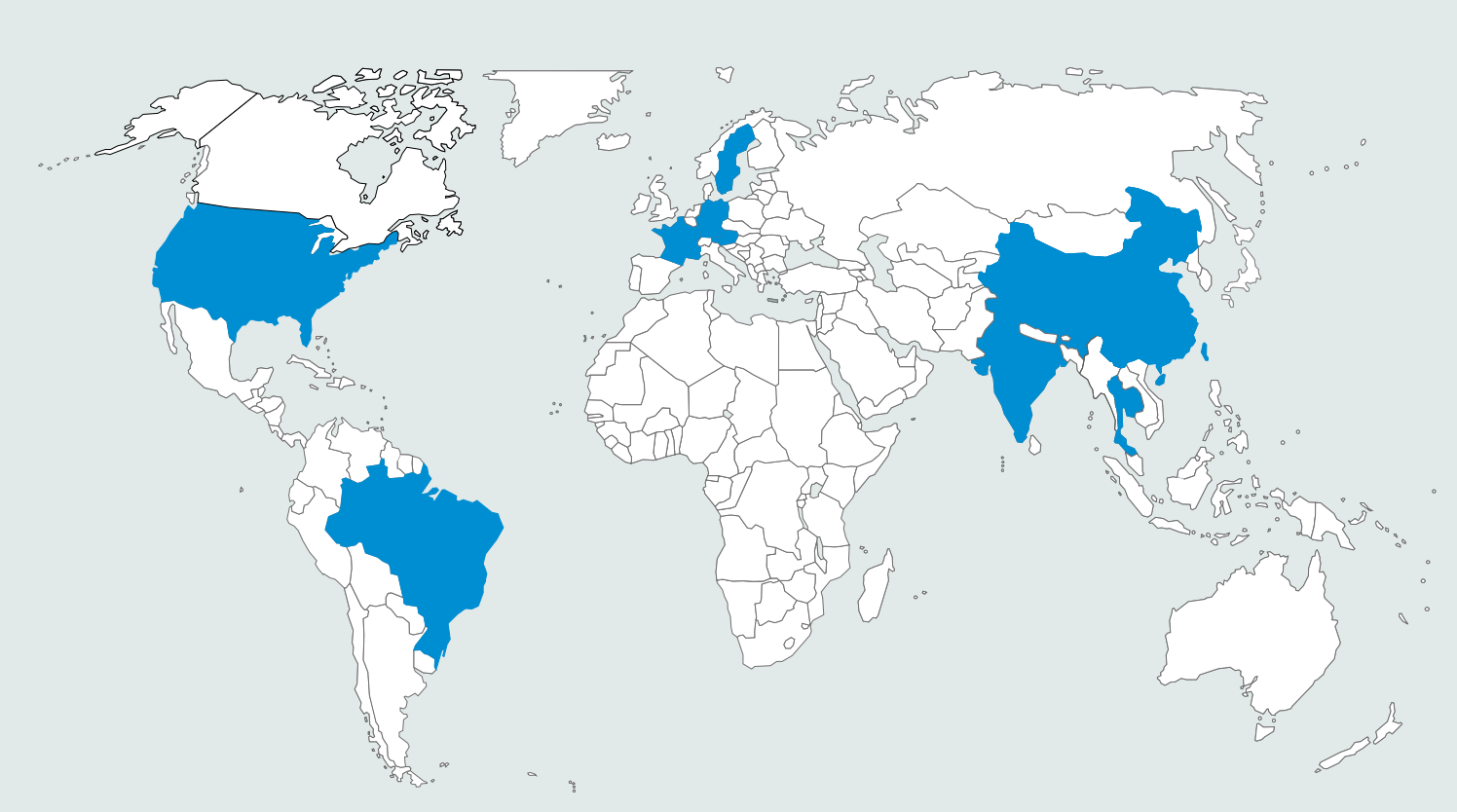
- Colouring paint without pigments
- Commodity polymers with self-organising smart coatings that respond to environmental changes by changing color and/or shape
- Supramolecular biomaterials for stem cell expansion
- Self-synthesizing gels
- Development of a SuperActive synthetic biomaterial to repair damaged tissues in the body
- Flexible memories made from coordination polymers.

Universities involved:

- AMC Amsterdam
- Delft University of Technology
- Eindhoven University of Technology
- University of Groningen
- Wageningen University & Research



Partners Industry 2018



Europe

ALTANA	Altana (left in 2018)
Bayer	Bayer (left in 2018)
BOREALIS	Borealis
MICHELIN	Michelin (left in 2018)
HUTCHINSON	Hutchinson (new in 2018)
SAINT-GOBAIN	Saint-Gobain (left in 2018)
SKF	SKF
SNF FLOERGER	SNF Floerger

North and South America

Braskem	Braskem
ExxonMobil	ExxonMobil
PETROBRAS	Petrobras (left in 2018)

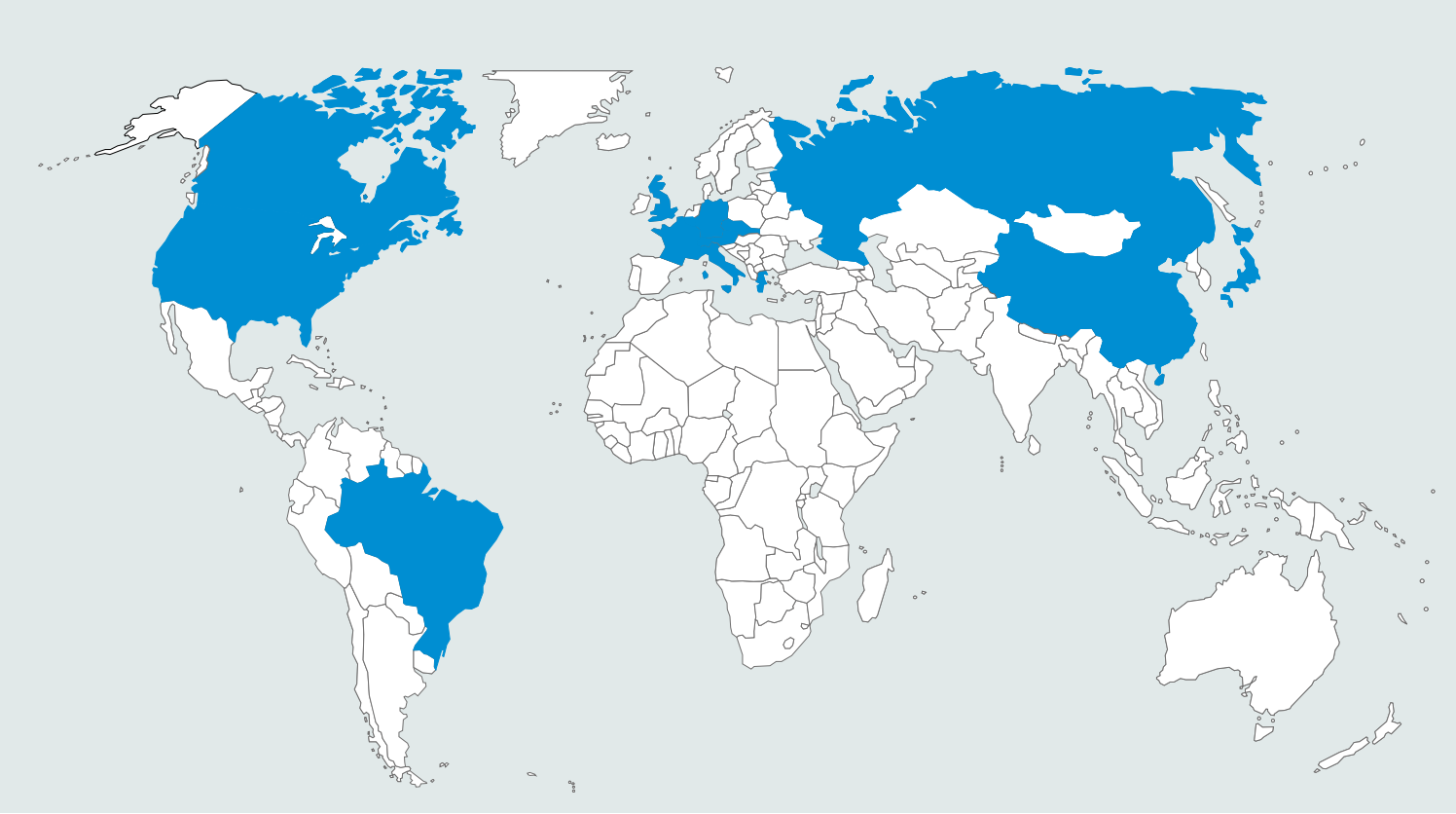
Asia

- Reliance
- SCG-Chemicals
- Sinopec

The Netherlands

- AkzoNobel
- Dow Benelux
- DSM
- Friesland Campina (left in 2018)
- Lanxess Elastomers (left in 2018)
- Lawter (left in 2018)
- Nouryon
- SABIC
- Shell
- Tejin Aramid

Partners Knowledge institutes 2018



Europe

- CNRS Strasbourg
- DWI an der RWTH Aachen (left in 2018)
- ESCPI-Lyon
- ETH Zurich
- Fraunhofer Institute for Structural Durability and System Reliability LBF (Rejoined in 2018)
- Ghent University
- Johannes Kepler University Linz (No research projects in 2018)
- KU Leuven
- Leibniz-Institut für Polymerforschung Dresden (rejoined in 2018)
- Lomonosov Moscow State University
- Martin-Luther University of Halle-Wittenberg (no research projects in 2018)
- Max Planck Institute for Polymer Research (no research projects in 2018)
- National Technical University of Athens (no research projects in 2018)
- The University of Manchester
- Université de Bordeaux (new in 2018)
- University of Chemistry and Technology Prague
- University of Naples Federico II
- University of Perugia
- University of Turin

North and South America, Asia

JAIST	Japan Advanced Institute of Science and Technology
CNPq	National Council for Scientific and Technological Development (CNPq) (no research projects in 2018)
TEXAS The University of Texas at Austin	The University of Texas at Austin
清華大學	Tsinghua University (no research projects in 2018)
UFRGS	UFRGS Universidade Federal do Rio Grande do Sul (no research projects in 2018)
Universidade Católica de Brasília	Universidade Católica de Brasilia (no research projects in 2018)
	Universidade Federal do Rio de Janeiro (no research projects in 2018)
University of Manitoba	University of Manitoba

The Netherlands

Amsterdam UMC Universitair Medische Centra	AMC Amsterdam
TU Delft	Delft University of Technology
TU/e	Eindhoven University of Technology
NWO	NWO (left in 2018)
	Radboud University
university of groningen	University of Groningen
UNIVERSITY OF TWENTE	University of Twente
Universiteit Utrecht	Utrecht University (new in 2018)
WAGENINGEN	Wageningen University & Research

Summary of financial data 2018

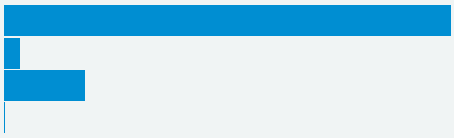
Income

	(x EUR million)	%
Contributions from industrial partners	2.60	37.0
Revenue Patents	0.07	1.0
Contributions from knowledge institutes	0.71	10.1
Subsidy of TKI Toeslag	2.91	41.4
Revenue TKI SPM	0.69	9.9
EU projects	0.04	0.6
Total income	**7.02**	**100.0**

Expenditure

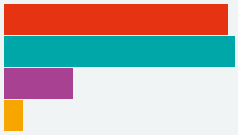
By nature

	(x EUR million)	%
Personnel costs	4.53	82.5
Depreciation	0.15	2.7
Other costs	0.81	14.8
EU projects	0.00	0.0
Total expenditure	**5.49**	**100**



By Programme Area

Polyolefins	1.77	41.5
Performance Polymers	1.82	42.6
Coatings Technology	0.54	12.6
Polymers for Oil and Gas	0.14	3.3
Sub total	**4.27**	**100**
Knowledge Transfer	0.13	
Organisation and support	0.95	
EU projects	0.00	
Business Development	0.14	
Total expenditure	**5.49**	



Key Performance Indicators 2018

Number of industrial partners

European governmental funding (% of total funding)

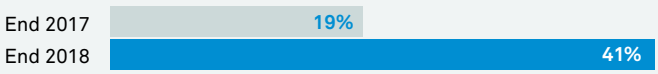
Number of partner knowledge institutes
(universities, etc.)

Participation of foreign knowledge institutes
as % of total expenditure

Industrial contribution (cash and in-kind)
as % of total income

Overhead costs
as % of total expenditure

Subsidy (TKI Toeslag)
as % of total income



Expenditure for knowledge transfer
x EUR million

Track record DPI researchers

Left in total	25
Employed by partner knowledge institute	12
Employed by non-partner knowledge institute	1
Employed by partner industrial company	0
Employed by non-partner industrial company or start-up	7
Unknown	5

Research output	2017	2018
Scientific publications	50	40
PhD theses	19	7
Average journal impact factor	5.42	3.85

DPI Annual Meeting 2018

This year, DPI's Annual Meeting was centred around the theme of a Circular Economy. Around 175 people from across the world attended the event, held at the Holiday Inn hotel in Eindhoven on 13 and 14 November. DPI had once again drawn up a varied programme comprising research review meetings, poster sessions, a Young DPI Meeting, a full afternoon session featuring four leading speakers on the subject of a Circular Economy and the Conference Dinner.

The morning of the first day was devoted to Review Meetings of the different Programme Areas and the poster sessions. After lunch, Jacques Joosten kicked off the afternoon session with a presentation in which he looked back on the DPI highlights of the year and looked forward to the future. The highlights included quantitative data on journal publications and PhD theses, selected scientific achievements and recognitions for DPI researchers and the some spin-offs resulting from DPI's research projects. Jacques also gave an update on developments in the four research areas of the new DPI programme. While the new programmes for Polyolefins, Performance Polymers and Polymers for Oil & Gas are up and running, the Functional Polymers and Surfaces programme has had to be put on hold owing to a lack of participations.

Jacques Joosten had an important announcement to make: in August 2018, DPI's Supervisory Board unanimously and definitively gave the green light for the continuation of DPI. The Supervisory Board – in which our industrial partners are represented – has faith in the future of DPI as a unique and viable international research platform. Jacques: "We see a clear upward trend and are all excited and keen to enter into a new era. In 2018 two new industrial partners joined DPI: Dow Chemical and Hutchinson. Our partner-base in the new set-up comprises 15 companies. At the moment, the number of industrial participations amount to 17 and we have a total of 53 projects in place involving 60 researchers. We are continuing in our efforts to increase the number of industrial partners and the number of participations. We aim to expand the volume of projects so as to eventually grow to some 150 researchers." Touching on more recent developments and linking up with the theme of the afternoon, Jacques Joosten updated the audience on DPI's recent initiatives to set the ball rolling in the area of Circular Economy. In October 2018, DPI organised a Polyolefins Circularity Workshop in cooperation with its industrial partners in the field of polyolefins. The goal of this initiative was to explore the technical and economic feasibility of achieving full circularity of flexible plastic packaging. The DPI polyolefins community, consisting of large multinationals with a global presence, represent an ideal base for launching such an initiative. As a key outcome of this initiative, DPI envisages a focused polyolefins recycling programme covering both mechanical and chemical recycling. The workshop was very successful and DPI is currently exploring the possibilities for follow-up actions. Earlier, in 2017, DPI – in association with a number of companies from across the polymer value chain – had created an exchange platform called PlasticsRevisited.

DPI ANNUAL MEETING 2018
Just Jansz

DPI Golden Thesis Award 2018

The DPI Golden Thesis Award for 2018 has been granted to Dr. Dirk Jan Mulder in recognition of his excellent research as published in the thesis Adjustable nanoporous polymers based on smectic liquid crystals. Dr. Mulder defended his thesis successfully in October 2017 at the Eindhoven University of Technology (Netherlands). The research described in the thesis formed part of the research programme of DPI and was conducted under the supervision of Prof. Albert Schenning, head of the Stimuli-responsive Functional Materials & Devices Research Group at the same university.

DPI GOLDEN THESIS AWARD 2018 –
Winner Dirk Jan Mulder, thesis nominee Hans van Franeker and the jury Thijs Michels, Costantino Creton and Dick Broer

The Golden Thesis Award is granted every two years for the best PhD thesis resulting from DPI-funded research. Dirk Jan Mulder was declared the winner from among the three finalists competing for this year's award. The other two candidates were: Hans van Franeker (Eindhoven University of Technology), with a thesis titled Droplets, fibers & crystals: controlling the nanostructure of polymer and perovskite solar cells, and Monica Zakhari (Eindhoven University of Technology) with a thesis titled Microscale simulations of the mechanics of spongy-particle systems. The award was presented during the plenary session of the DPI Annual Meeting 2018 in Eindhoven on 13 November.

Circular Economy

The four invited speakers spoke to a packed audience about the different aspects of the challenges that plastics are presenting to the world today and the need to find solutions that will help achieve a circular economy for plastics.

Dr. Søren Bøwadt, of the Directorate-General for Research & Innovation at the European Commission, stated that the resources of our planet are increasingly under pressure from an ever-growing population and its material needs. To facilitate a circular economy in which the environmental footprint is reduced while safeguarding industrial competitiveness and the global standard of living, a holistic strategy for plastics is needed that involves all actors in the value chain and has the active support of the public authorities. The European Union's Circular Economy Package, he said, designated plastics as a priority area and its Plastics Strategy focused on four key areas for action: improving the economics and quality of plastics recycling, curbing plastic waste and littering, driving innovation and investment towards circular solutions, and harnessing global action.

DPI ANNUAL MEETING 2018
Søren Bøwadt

Dr. Just Jansz, founder and managing director of the consultancy firm Expertise Beyond Borders, emphasised that given the growing public concern about plastic waste, industry must embrace the circular economy. He argued that plastic waste is in fact an unused but valuable feedstock. Full circularity of plastics, he said, cannot be realised through mechanical recycling alone; it will also require chemical conversion technologies to enable feedstock recycling or regeneration, including depolymerisation, pyrolysis and gasification. The toolbox we need should include thermal conversion, i.e. incineration with energy recovery and proper off-gas cleaning. He urged polymer producers to act and become part of the solution.

Prof. Kim Ragaert, professor of Materials Science and Polymer Processing at Ghent University (Belgium), gave a talk titled "To recycle or not to recycle – it's hardly a question", focusing on mechanical recycling as the most common means of revalorising plastic waste. She walked the audience through the current state of affairs with regard to mechanical recycling in Europe, looking at what is being recycled and how. After identifying the major hurdles – both technical and otherwise – that stand in the way of recycling in terms of quality and quantity, she went on to take a critical look at the challenges and consider ways in which these could be overcome.

Dr. Patricia Vangheluwe, Director of Consumer & Environmental Affairs at PlasticsEurope, pointed out that while plastics continue to benefit society, in the public perception these benefits are being overshadowed by the negative consequences associated with them.

DPI ANNUAL MEETING 2018
Patricia Vangheluwe

DPI ANNUAL MEETING 2018
Kim Ragaert

A more collaborative effort across value chains is needed to achieve a Circular Economy. PlasticsEurope has formulated ambitious targets for 2030, with a voluntary commitment from member companies to work towards their achievement. Dr. Vangheluwe mentioned a number of initiatives taken at the European level that should stimulate efforts towards achieving circularity: the European Commission's Plastics Strategy, SusChem's Plastics SIRA (Strategic Innovation & Research Agenda), the presence of SusChem's European Technology Platform and various sector-specific initiatives such as Styrenics Circular Solutions and Polyolefins Circular Economy Platform. PlasticsEurope is cooperating on a global level with bodies such as the Global Plastics Alliance.

Poster Award

The DPI Annual Meeting gives scientists working on DPI projects an opportunity to present their research by means of posters and compete for the DPI Poster Award. In keeping with the practice introduced last year, all attendees of the annual meeting were invited to rate the posters and cast their votes for the three best posters. The first prize was awarded to Hanne van der Kooij for her poster entitled "Soft materials in a new light - Illuminating nanoscale dynamics by Laser Speckle Imaging". The second prize went to Rob Verpaalen ("Programmable helical twisting in oriented bilayer films") and the third prize to Annelore Aerts ("π-extended anthracene as mechanophore").

Hanne van der Kooij's research, which she is conducting at Wageningen University in the Netherlands, concerns a technique called Laser Speckle Imaging, which is used for elucidating the hidden dynamics in turbid systems. It is already being used in medical applications for imaging subcutaneous blood streams. In her research project, Hanne van der Kooij's is exploring its use for the imaging of opaque and turbid systems such as coatings. The technique is also proving to be useful in the case of self-healing and self-cleaning materials, for example. Within the DPI framework, Hanne's supervisor Dr. Joris Sprakel is working with coatings companies to explore commercialisation of the technique, which according to her can also be used to examine the quality of coatings and the possibilities for making them greener and better. Hanne van der Kooij: "The project was initiated by Dr. Sprakel, who wanted to gain more insight into certain aspects of coatings, which are fascinating complex systems and whose drying process plays such a crucial role in their use. The Laser Speckle Imaging technique makes this possible."

Conference Dinner

In keeping with tradition, a Conference Dinner was held on the evening of the first day. It offered the guests – some 125 people from a variety of companies and universities – the opportunity to get to know one another in an informal setting while enjoying the delicacies served up by the Holiday Inn kitchen staff.

Young DPI Meeting

This year's Young DPI Meeting was held on Monday, 12 November, the day before the start of the two-day Annual Meeting. The purpose of the Young DPI Meeting is to enable new researchers starting work on a DPI project to get acquainted with the DPI organisation and to get to know one another.

WINNERS OF THE DPI POSTER AWARDS
Annelore Aerts and Hanne van der Kooij

YOUNG DPI MEETING 2018

Participants represented a broad international spectrum and included Belgian, Chinese, German, Indian and Japanese researchers working in the Netherlands; German and Iranian researchers working in Belgium; Chinese, Kazakh and Russian researchers working in France; and Czech researchers working in Prague.

The meeting, which was organised along the same general lines as in previous years, was a great success and was highly appreciated by the young researchers.

POLYOLEFINS

The Polyolefins research programme encompasses the entire spectrum of the knowledge chain. The aim is to create the knowledge base needed to support the ever-expanding range of applications.

Polyolefin-based materials can be customised for many different applications: from ultra-rigid thermoplastics to high-performance elastomers. This wide performance scope is achieved through a variety of polyolefin molecular structures, whose common features are high atom economy in their synthesis, low cost, excellent properties, a long life cycle and ease of recycling.

The programme focuses on deepening of understanding of polyolefin catalysis, reaction engineering, processing and material properties and the development of new methods and methodologies to support the ongoing transition from empirical to fundamental understanding.

SUB-PROGRAMMES

Catalysis
Investigating, screening and developing (novel) homogeneous and heterogeneous catalyst systems, as well as new approaches for the immobilisation of molecular catalysts, new co-catalysts and activators.

Polymer structure, properties and processing
Understanding, modelling and predicting structure-processing property relationships in polyolefin-based polymer systems.

Polymer reactor engineering
Studying various reactor and technology unit operations to develop a quantitative description and acquire a thorough understanding of the crucial aspects of olefin polymerisation processes.

New methods and exploratory research
New polymerisation and polymer characterisation methods, high-throughput screening and experimentation, embryonic research and concept development.

FACTS AND FIGURES

Partners from industry
- Borealis
- Braskem
- Dow Benelux
- ExxonMobil
- Reliance
- SABIC
- SCG Chemicals
- Sinopec

Partners from the research world
- Eindhoven University of Technology
- ESCPI-Lyon
- ETH Zurich
- Fraunhofer Institute for Structural Durability and System Reliability LBF
- Japan Advanced Institute of Science and Technology
- Leibniz-Institut für Polymerforschung Dresden
- Lomonosov Moscow State University
- The University of Texas at Austin
- Utrecht University
- University of Chemistry and Technology Prague
- University of Groningen
- University of Manitoba
- University of Naples Federico II
- University of Perugia
- University of Turin

Budget and organisation
Expenditure in 2018 totalled € 1.77 million. The total number of FTEs allocated at year-end 2018 was 17.9 (28 researchers). Prof.dr. Vincenzo Busico was Scientific Chair and Dr. Jan Stamhuis and Dr. Jan Smook were Programme Area Coordinators of the Polyolefins programme.

Publications and inventions
This programme area generated a total of fifteen reviewed papers, three theses and one reported invention.

For details, see page 24

PERFORMANCE POLYMERS

Performance Polymers possess superior chemical, mechanical and physical properties, especially beyond ambient conditions. They are usually used as multi-component polymeric systems consisting of various polymers, reinforcements and additives.

The research focus of the Programme Area Performance Polymers is to enhance the performance of different polymeric systems by combining chemistry, physics and engineering science. This leads to a better understanding of the "structure versus performance" relationship on all length scales – from molecular to macroscopic. Via the generated knowledge, the Performance Polymers programme provides opportunities for responding to the new sustainability challenges posed to the industrial sectors of automotive, aerospace, electronics, oil & gas transport and construction.

SUB-PROGRAMMES

Polymer and network chemistry and modification
Studies aimed at expanding the use of bio-based materials, by identifying their unique properties and reducing their eco-footprint. Further studies are designed to reduce the costs and energy use in polymerisation. Other objectives are network formation and the development of new concepts for monomer polymer molecular structure to achieve gradual changes in the balance of flow properties, static and dynamic mechanical behaviour and other functional properties.

Processing for properties, polymer physics and modelling
Understanding the relationship between the molecular structure, processing and properties of polymers. Studies of the processing effects of intermolecular interactions, e.g. hydrogen bonding. Processing, modification and vulcanisation studies of elastomer blends. Studies of complex flow behaviour, e.g. in particle reinforced visco-elastic materials.

Advanced reinforced thermoplastics and synthetic fibres
Studies of the interface effects in fibre-reinforced composite systems, the effects of nano-reinforcement on polymer material properties on macroscopic and microscopic scale with a focus on the effects at the matrix-filler interface, friction and wear studies of fibre-reinforced thermoplastics and elastomers.

Long term stability and performance
Investigation of the effect of ageing and use conditions on the performance of thermoplastic composites with the ultimate goal of predicting lifetime and attaining a fit-for-purpose design over the entire lifecycle.

FACTS AND FIGURES

Partners from industry
- DSM
- Hutchinson
- Nouryon
- SABIC
- Shell
- SKF
- Tejin Aramid

Partners from the research world
- CNRS Strasbourg
- Eindhoven University of Technology
- Ghent University
- KU Leuven
- Radboud University
- The University of Manchester
- University of Groningen
- University of Twente

Budget and organisation
Expenditure in 2018 totalled € 1.83 million. The total number of FTEs allocated at year-end 2018 was 13.1 (20 researchers). Prof.dr. Costantino Creton was Scientific Chair and Dr. Denka Hristova-Bogaerds was Programme Area Coordinator of the Performance Polymers programme.

Publications and inventions
This programme area generated a total of fourteen reviewed papers and two theses.

For details, see page 25

COATINGS TECHNOLOGY

Within the Coatings Technology (CT) area frontier research in the general field of organic coatings is performed. The aim is to develop fundamental insights that will lead to innovative coatings technologies. The research is pre-competitive and is focussed at achieving sustainability, quality of life improvements, economic growth and preparing the coatings industry for future challenges.

OBJECTIVES

The research programme for Coatings Technology (CT) concentrates on exploring novel coating materials and technologies and acquiring fundamental insights into the structure-properties relationships of coatings to enable the coatings industry to meet future challenges. The research programme is based on three pillars: renewable raw materials and novel, environmentally friendly coating technologies; functional (smart) coatings; durability and testing of coatings.

SUB-PROGRAMMES

Renewable raw materials, formulation and powder coatings
There are currently three projects underway to study the feasibility of applying sustainable, renewable resources in coatings technology without compromising the properties of the final coating (film). The programme focuses on bio-based building blocks and raw materials as substitutes for materials derived from petrochemistry and their use in novel coating technologies. Systems being studied include polycarbonate powder coatings or waterborne polyurethane dispersions, as well as starch-based performance coating materials. The results are promising in that coatings have already been obtained which match and/or improve on the properties of purely synthetic coatings.

Functional (smart) coatings
'Smart coatings' are capable of responding to an external stimulus, such as light, temperature, pressure, pH, odours or gas. The stimulus causes a change in the coating's properties which may be permanent or reversible. Coatings with self-healing properties in response to mechanical damage or with light- or moisture-induced self-cleaning properties are of particular interest and have already been studied. Research on protective coatings that can adapt to their environment and/or conditions under which they are used is at the embryonic stage, but such systems, as well as tailored coatings for medical diagnostics (e.g. test strips) and implants, seem feasible in the future. The same applies for coatings with special optoelectronic and electronic properties that could be used in electronic devices and information technology.

Durability and testing of coatings
The aim is to gain a fundamental understanding of the degradation mechanisms of coatings used in outdoor exposure to enhance durability. Another objective of this sub-programme is to develop new testing methods for coatings, e.g. methods for testing adhesion, gloss or scratch resistance, which correlate to meaningful physical parameters. Last but not least, DPI collaborates intensively with the Materials Innovation Institute's 'Materials to Innovate' (M2i) programme in the study of anti-corrosion coatings

FACTS AND FIGURES

Partners from the research world
- Eindhoven University of Technology
- University of Groningen
- Wageningen University & Research

Budget and organisation
Expenditure in 2018 totalled € 0.54 million. The total number of FTEs allocated at year-end 2018 was 4 (8 researcher). Prof. dr. Dick Broer was scientific chair and Ronald Korstanje acted as Programme Area Coordinator of this programme area.

Publications and inventions
The research programme in this programme area generated a total of one reviewed paper and one thesis.

For details, see page 26

POLYMERS FOR OIL AND GAS

Polymers find broad application in the recovery, transport and utilisation of oil and gas, e.g. as oil field chemicals or as light-weight materials with superior durability properties. The aim of the Polymers for Oil and Gas programme is to generate tools and new insights into existing and new polymers for utilisation in the exploration, production and transport of oil and gas.

Two main areas of study are distinguished: firstly, the use of polymers in fluids for enhanced oil recovery (EOR) and other sub surface drilling/recovery applications. Secondly, the behaviour of polymers in functional materials used under extreme/adverse conditions (in close collaboration with the Performance Polymers programme area).

SUB-PROGRAMMES

Structure–property relationships and the design of new model macromolecules
Controlled radical polymerisation techniques will be employed to investigate the effects of macromolecular topology, for example branching, on polymer solution properties and on viscosity and/or visco-elasticity. These novel structures are evaluated in core flow experiments to determine their injectivity and impact on the recovery of oil in porous media. The effects of polymeric surfactants, i.e. high molecular weight amphiphilic structures that have the potential to decrease the interfacial tension and enhance oil recovery compared with that obtained with the current polymer flooding applications, are also being investigated.

Relating polymer rheology to apparent viscosity in porous media
The objective of this sub-programme is to develop reliable models to predict the relationship of polymer-apparent viscosity in porous media to porous-medium properties, bulk rheological parameters and superficial velocity in the medium and establish the relationship with enhanced oil recovery.

FACTS AND FIGURES

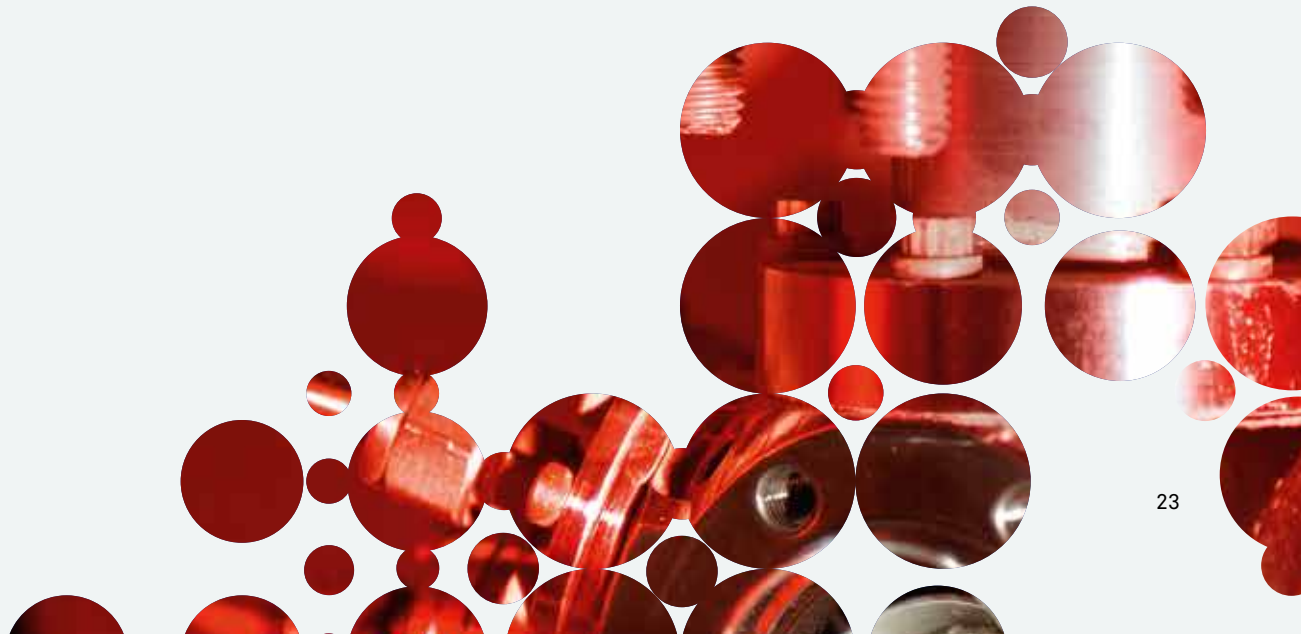
Partners from industry
- Shell
- SNF Floerger

Partners from the research world
- Université de Bordeaux
- University of Twente

Budget and organisation
Expenditure in 2018 totalled € 0.14 million. The total number of FTEs allocated at year-end 2018 was 1.8 (2 researchers). Dr. Jan Stamhuis was Programme Area Coordinator of the Polymers for Oil and Gas programme.

Publications and inventions
The research programme in this programme area generated a total of two reviewed papers.

For details see page 26



Output 2018

POLYOLEFINS

Projects

#632: Experimental and computational study of dense gas-fluidised beds with liquid injection

#751: Predictive Modelling of Polyolefin Reactors

#754: Computational Modeling of Ziegler-Natta Propene Polymerization Catalysts: Chemical Reactivity

#785: High Impact Polypropylene: Structure Evolution and impact on Reaction

#791: A comprehensive integrated HTC&HTE workflow for the mechanistic study of (novel) olefin polymerization catalysts

#793: Novel Quadrupolar Nuclear Magnetic Resonance Methodology for the Study of MgCl2-Supported Ziegler-Natta Catalysts

#800: Quantitative Structure-Activity Relationships (QSAR) in Metallocene-Based Olefin Polymerization Catalysis

#801: Predictive modelling of mechanical anisotropy in oriented semi-crystalline polymers directly from morphological characteristics

#802: Structure determination at the nanoscale and atomic dynamics of MgCl2 primary particles in Ziegler-Natta catalysts

#803: HEat Management in Polymerization Reactors (HEMPR)

#804: From homogeneous to "colloidal" olefin polymerization catalysts: effects of mass transport limitations on reaction kinetics and polymer microstructure

#809: Transparant High Impact Composites

#810: Online Polyolefin structuring during Cast Film Extrusion

#813: Multi-scale investigation of silica-supported ethylene polymerization catalysts during the early stages of the reaction

#814: Control of crystallisation, chain entanglement and rheology via process conditions

#815: Augment the macroscopic PROperties of i-PP composites by controlling the microscopic Fiber-matrix Interactions via Transcrystallization

#816: Correlation between process-induced crystallization and mechanical properties in injection molded isotactic polypropylene (iPP)

#817: An inter-disciplinary high-throughput approach to olefin block copolymers

#907: Gas Phase Propylene (Pre)Polymerisation: Impact of catalyst activation, prepolymerisation and support morphology on polypropylene production

#908: SUrface SPecies in Ziegler-Natta Catalysts by dnp sENS

#909: Reactivity and Mechanisms in Post-Metallocene Polyolefin Catalysis Studied by Dissolution Dynamic Nuclear Polarization

#919: Structure-Activity-Polymer Property Studies on a Novel Ziegler-Natta Olefin Polymerization Model System

#920: Separation of PolyOlefins by Long-chain Branching (SPOLB)

Theses

Miguel Plata
High Impact Polypropylene –Structure Evolution and Impact on Reaction

Eric Cuthbert
A High-Throughput Experimental/ Computational Investigation of Zirconium and Hafnium O4 Catalysts for Propene Polymerization

Merijn Blaakmeer
MgCL2- Supported Ziegler- Natta Catalysts; An NMR perspective

Scientific publications

A. Alizadeh and T. F. L. McKenna
Particle growth during the polymerization of olefins on supported catalysts. Part 2: Current experimental understanding and modeling progresses on particle fragmentation, growth, and morphology development
Macromolecular Reaction Engineering 12(1)

A. Alizadeh, F. Sharif, M. Ebrahimi and T. F. L. McKenna
Modeling condensed mode operation for ethylene polymerization: Part iii. Mass and heat transfer
Industrial & Engineering Chemistry Research 57(18) 6097-6114

M. Banaei, N. G. Deen, M. V. Annaland and J. A. M. Kuipers
Particle mixing rates using the two-fluid model
Particuology 36(13-26

M. Banaei, R. Dellaert, N. G. Deen, M. V. Annaland and J. A. M. Kuipers
Borescopy in pressurized gas-solid fluidized beds
Aiche Journal 64(9) 3303-3311

M. Banaei, J. Jegers, M. V. Annaland, J. A. M. Kuipers and N. G. Deen
Tracking of particles using tfm in gas-solid fluidized beds
Advanced Powder Technology 29(10) 2538-2547

M. A. Bashir and T. F. L. McKenna
Reaction engineering of polyolefins: The role of catalyst supports in ethylene polymerization on metallocene catalysts
Polymer Reaction Engineering of Dispersed Systems, Vol I 280(19-63

M. A. Bashir, V. Monteil, C. Boisson and T. F. L. McKenna
The effect of aluminum alkyls and bht-h on reaction kinetics of silica supported metallocenes and polymer properties in slurry phase ethylene polymerization
Journal of Applied Polymer Science 135(2)

E. S. Blaakmeer, E. R. H. van Eck and A. P. M. Kentgens
The coordinative state of aluminium alkyls in ziegler-natta catalysts
Physical Chemistry Chemical Physics 20(12) 7974-7988

E. S. M. Blaakmeer, G. Antinucci, A. Correa, V. Busico, E. R. H. van Eck and A. P. M. Kentgens
Structural characterization of electron donors in ziegler-natta catalysts
Journal of Physical Chemistry C 122(10) 5525-5536

E. S. M. Blaakmeer, G. Antinucci, E. R. H. van Eck and A. P. M. Kentgens
Probing interactions between electron donors and the support in mgcl2-supported ziegler-natta catalysts
Journal of Physical Chemistry C 122(31) 17865-17881

E. Breuza, G. Antinucci, P. H. M. Budzelaar, V. Busico, A. Correa and C. Ehm
Mgcl2-supported ziegler-natta catalysts: A dft-d "flexible-cluster" approach to internal donor adducts
Journal of Physical Chemistry C 122(16) 9046-9053

A. J. Cancelas, M. A. Plata, M. A. Bashir, M. Bartke, V. Monteil and T. F. L. McKenna
Solubility and diffusivity of propylene, ethylene, and propylene-ethylene mixtures in polypropylene
Macromolecular Chemistry and Physics 219(8)

A. J. Cancelas, L. Yang, R. Girod, J. de Heer, R. Kleppinger, E. Delsman, J. Wang, M. Gahleitner, V. Monteil and T. F. L. McKenna
The effect of reactor conditions on high-impact polypropylene properties and gas phase polymerization kinetics
Macromolecular Reaction Engineering 12(4)

C. Ehm, A. Vittoria, G. P. Goryunov, P. S. Kulyabin, P. H. M. Budzelaar, A. Z. Voskoboynikov, V. Busico, D. V. Uborsky and R. Cipullo
Connection of stereoselectivity, regioselectivity, and molecular weight capability in rac-r-2 ' si(2-me-4-r-indenyl)(2)zrcl2 type catalysts
Macromolecules 51(20) 8073-8083

H. S. Zijlstra, A. Hofmann and S. Harder
Reactivity of a bulky bora-amidine ligand with trimethylaluminum
Zeitschrift Fur Anorganische Und Allgemeine Chemie 644(21) 1252-1256

Reported invention

#809: S.A.J. Houben and C.W.M. Bastiaansen Transparent, High Impact Composites

PERFOMANCE POLYMERS

Projects

#745: Microstructure-based Modeling of the Intrinsic Kinectics of Ageing and Deformation of Polymer Glasses

#749: The chemistry of rubber modification and crosslinking: New approaches towards an old problem. Continuation of DPI project #749

#772: Emergent properties of biomolecular systems: structural/dynamic characterization and development of new functionalities

#782: How short-cut fibers influence friction, wear and noise generation of polymers

#783: Contact mechanics, friction and contact fatigue on polymeric surfaces

#786: Processing for Enhanced Product Performance

#788: Predicting the Fountain Flow Instability from Material Properties and Processing conditions

#794: Microbial Synthesis of Functional Polyhydroxyalkanoates (PHA)

#796: REFINE

#805: Probing interfacial damage in composites with mechanofluorescence

#806: 2D Material Coatings for Fibres

#811: Reliable Prediction of Residual Structural Integrity and Damage- Evolution During Long-Term Fatigue in Thermoplastic Composites

#812: Physics-based fatigue design tool for matrix cracking and delamination in unidirectional and sandwich composites under multi-axial fatigue loads with arbitrary R-ratio : development, validation and finite element implementation

#819: Controlling electrical percolation in hybrid thermoplastic composites through informed selection of fillers

#820: Microstructure-based Modeling of the Intrinsic Kinectics of Ageing and Deformation of Polymer Glasses

#827: Impact Modelling of Polymers: high-Rate Experiments for Solid-state Simulations

#916: Development of Dynamic Nuclear Polarization (DNP) NMR for the study of polymer surfaces, interfaces, fillers and coatings

#917: Polymer extrusion of particle filled systems

#918: Optimization of interface strenght in advanced polymer composite materials

Theses

Frank Aangenendt
Mechanics and Dynamics of Soft, Sponge–Like Particles

Monica Zakhari
Microscale simulations of the mechanics of spongy-particle systems

Scientific publications

M. Khafidh, D. J. Schipper, M. A. Masen, N. Vleugels and J. W. M. Noordermeer
Tribological behavior of short-cut aramid fiber reinforced sbr elastomers: The effect of fiber orientation
Journal of Mechanical Engineering and Sciences 12(2) 3700-3711

M. Khafidh, B. Setiyana, J. Jamari, M. A. Masen and D. J. Schipper
Understanding the occurrence of a wavy wear track on elastomeric materials
Wear 412(23-29

M. Li, J. Bijleveld and T. J. Dingemans
Synthesis and properties of semi-crystalline poly(decamethylene terephthalamide) thermosets from reactive side-group copolyamides
European Polymer Journal 98(273-284

M. Li, Q. B. Guan and T. J. Dingemans
High-temperature shape memory behavior of semicrystalline polyamide thermosets
Acs Applied Materials & Interfaces 10(22) 19106-19115

N. Migliore, L. M. Polgar, R. Araya-Hermosilla, F. Picchioni, P. Raffa and A. Pucci
Effect of the polyketone aromatic pendent groups on the electrical conductivity of the derived mwcnts-based nanocomposites
Polymers 10(6)

E. Parodi, G. W. M. Peters and L. E. Govaert
Prediction of plasticity-controlled failure in polyamide 6: Influence of temperature and relative humidity
Journal of Applied Polymer Science 135(11)

E. Parodi, G. W. M. Peters and L. E. Govaert
Structure-properties relations for polyamide 6, part 2: Influence of processing conditions during injection moulding on deformation and failure kinetics
Polymers 10(7)

L. V. Pastukhov, F. P. M. Mercx, T. Peijs and L. E. Govaert
Long-term performance and durability of polycarbonate/carbon nanotube nano-composites
Nanocomposites 4(4) 223-237

L. M. Polgar, F. Criscitiello, M. van Essen, R. Araya-Hermosilla, N. Migliore, M. Lenti, P. Raffa, F. Picchioni and A. Pucci
Thermoreversibly cross-linked epm rubber nanocomposites with carbon nanotubes
Nanomaterials 8(2)

L. M. Polgar, J. Keizer, R. Blom, B. Niemeijer, T. de With, F. Picchioni and M. van Duin
Thermoreversible cross-linking of rubber compounds: From proof-of-concept toward an industrial process
Rubber Chemistry and Technology 91(2) 492-508

X. Y. Yang, S. S. Liu, A. V. Korobko, S. J. Picken and N. A. M. Besseling
Changes of the molecular mobility of poly(epsilon-caprolactone) upon drawing, studied by dielectric relaxation spectroscopy
Chinese Journal of Polymer Science 36(5) 665-674

M. E. A. Zakhari, P. D. Anderson and M. Hutter
Modeling the shape dynamics of suspensions of permeable ellipsoidal particles
Journal of Non-Newtonian Fluid Mechanics 259(23-31

M. E. A. Zakhari, M. Hutter and P. D. Anderson
Effect of particle-size dynamics on flow properties of dense spongy-particle systems
Journal of Rheology 62(2) 543-557

M. E. A. Zakhari, M. Hutter and P. D. Anderson
Stress relaxation of dense spongy-particle systems
Journal of Rheology 62(4) 831-843

COATINGS TECHNOLOGY

Projects

#781: Film Formation in Complex Colloidal Coatings

#910: Tuning the rheology of waterborne Polyurethane binoter+thickener mixtures

#911: Tuning the interactions between silica fillers and polymer binders towards hard and crack resistant water-based coatings

#912: Phase stability, dynamics and structure of binary aqueous polymer dispersions

#913: Laser speckle Imaging of drying dynamics in waterborne coatings

#914: In-situ investigation of the film information process in waterborne coatings

#915: Self-dispersible thermoplastic polymers

Thesis

Peter Albers
Design and network characterization of low friction hydrophilic polyether-urethane coatings

Scientific publication

H. M. van der Kooij, S. Dussi, G. T. van de Kerkhof, R. A. M. Frijns, J. van der Gucht and J. Sprakel
Laser speckle strain imaging reveals the origin of delayed fracture in a soft solid
Science Advances 4(5)

FUNCTIONAL POLYMER SYSTEMS

Thesis

Ling Liu
Light switchable surface topographies: Modelling and design of photo responsive topographical changes of liquid crystal polymer films

Scientific publications

V. S. R. Jampani, D. J. Mulder, K. R. De Sousa, A. H. Gelebart, J. P. F. Lagerwall and A. P. H. J. Schenning
Micrometer-scale porous buckling shell actuators based on liquid crystal networks
Advanced Functional Materials 28(31)

J. Lugger, D. J. Mulder, R. Sijbesma and A. Schenning
Nanoporous polymers based on liquid crystals
Materials 11(1)

D. J. Mulder, T. Liang, Y. F. Xu, J. ter Schiphorst, L. M. W. Scheres, B. M. Oosterlaken, Z. Borneman, K. Nijmeijer and A. P. H. J. Schenning
Proton conductive cationic nanoporous polymers based on smectic liquid crystal hydrogen-bonded heterodimers
Journal of Materials Chemistry C 6(18) 5018-5024

I. Rorich, A. K. Schonbein, D. K. Mangalore, A. H. Ribeiro, C. Kasparek, C. Bauer, N. I. Craciun, P. W. M. Blom and C. Ramanan
Temperature dependence of the photo- and electroluminescence of poly(p-phenylene vinylene) based polymers
Journal of Materials Chemistry C 6(39) 10569-10579

LARGE-AREA THIN-FILM ELECTRONICS

Scientific publication

C. Kasparek, I. Rorich, P. W. M. Blom and G. J. A. H. Wetzelaer
Efficiency of solution-processed multilayer polymer light-emitting diodes using charge blocking layers
Journal of Applied Physics 123(2)

POLYMERS FOR OIL AND GAS

Projects

#807: Smart brines for minimal surface adsorption in polymer EOR

#808: Adsorption/retention of Polymer in Porous Media

#818: Experimental and Numerical Evaluation of Polymer Viscoelasticity Effects during EOR Applications

Scientific publications

B. Klemm, F. Picchioni, P. Raffa and F. van Mastrigt
Star-like branched polyacrylamides by raft polymerization, part ii: Performance evaluation in enhanced oil recovery (eor)
Industrial & Engineering Chemistry Research 57(27) 8835-8844

B. Klemm, F. Picchioni, F. van Mastrigt and P. Raffa
Starlike branched polyacrylamides by raft polymerization-part i: Synthesis and characterization
Acs Omega 3(12) 18762-18770

Thesis

Simone Hendrikse
The Journey of Supramolecular Polymers to Biomaterials: From Fundamental Studies to Applications

NEWPOL

Projects

#731.015.501: Photonic supralatices for pigment-free colour in waterbased coatings

#731.015.502: Responsive Commodity Polymers

#731.015.503: Supramolecular Biomaterials with a Dual Network Architecture for Stem Cell Expansion

#731.015.504: Self-Synthesizing Hydrogels

#731.015.505: Supramolecular Biomaterials with Antimicrobial and Regenerative Activity

#731.015.506: Towards flexible memories with coordination polymers with polar rotors

CORPORATE RESEARCH

Scientific publications

E. Maaskant, W. Vogel, T. J. Dingemans and N. E. Benes
The use of a star-shaped trifunctional acyl chloride for the preparation of polyamide thin film composite membranes
Journal of Membrane Science 567(321-328

Z. P. Madzarevic, H. Schut, J. Cizek and T. J. Dingemans
Free volume in poly(ether imide) membranes measured by positron annihilation lifetime spectroscopy and doppler broadening of annihilation radiation
Macromolecules 51(23) 9925-9932

J. Razzokov, S. Naderi and P. van der Schoot
Nanoscale insight into silk-like protein self-assembly: Effect of design and number wof repeat units
Physical Biology 15(6)

DPI ...

DPI is a foundation funded by Dutch industry, universities and the government which was set up to perform exploratory research in the area of polymer materials.

DPI operates at the interface of universities and industry, linking the scientific skills of university research groups to the industrial need for innovation.

DPI carries out pre-competitive research projects to add value to the scientific community through scientific publications and to the industrial community through the creation of intellectual property.

DPI provides a unique platform for generating awareness of new technology, in which participating industrial companies, competitors in the market place, communicate on a pre-competitive basis to trigger innovation.

DPI integrates the scientific disciplines and know-how of universities into the 'chain of knowledge' needed to optimise the conditions for making breakthrough inventions and triggering industrial innovation.

DPI aims to combine scientific excellence with a genuinely innovative impact in industry, thereby creating a new mindset in both industrial and academic research.

DPI aims to fill the innovation gap between industry and universities and so resolve the Dutch Paradox of scientific excellence and lack of innovation.

Some 60 researchers (PhDs and Post-Docs) are currently involved in DPI projects at knowledge institutes throughout the world.

DPI
The Polymer
Research Platform

Mail address
P.O. Box 902
5600 AX Eindhoven
The Netherlands

Visiting address
Kennispoort
John F. Kennedylaan 2
5612 AB Eindhoven

T +31 (0) 40 247 56 29
F +31 (0) 40 247 24 62

info@polymers.nl
www.polymers.nl