Toegekende projecten Chemistry of Advanced Materials (CoAM)

Lopende projecten

Drying of colloid-polymer mixtures and the role of interactions and phase stability CHEMIE.PGT.2018.006
Eindhoven University / Akzo Nobel

Formulations used to make coatings are usually complex liquids: they contain, for example, binder particles, inorganic nanoparticles, polymers and/or surfactants. The binder particles in, for example, water-based paint that determine the final coating structure often consist of polymers that self-organize in water. Inorganic nanoparticles such as silica or titanium oxide are often essential for the optical properties of the coating. In addition, surfactants and/or polymers are often added to the formulations to improve the stability and/or viscosity of the formulations. During the drying of the formulation, the system becomes more and more concentrated and all kinds of processes occur that we want to understand better. We will study these theoretically and investigate experimentally with the help of model systems. This helps to gain insights into the distribution of the various components in the final coating. This allows us to build up an understanding of the mechanisms by which the inhomogeneity of a coating can be influenced. This can lead to improved coatings and completely new coatings in which, for example, controlled multilayers are made.

Heavy duty transport packaging from recycled plastics CHEMIE.PGT.2021.018
Wageningen University

World-wide transportation of machinery is facilitated by boxes, crates, wooden skids and various other packaging solutions. These product are currently made by Fladderak Industrial Packagings from Rotterdam. At present, most of the heavy duty packaging is custom made and based on wood. The use of virgin wood for this type of products becomes an issue when focusing on the sustainability of such products. Consequently, this project focuses on finding more sustainable materials, such as recycled plastic as a source to create boxes which have a long-life, better performance and support the environment. The transport packaging is custom made and return of transport packaging specifically from poorer regions (remote areas in Africa, South-America and Asia) is too costly. Therefore new solutions are needed in which packaging parts can be reused in other applications by the local population when they are disposed of, for example for roofing. For this purpose and also to facilitate custom made packaging systems a modular system based on recycled plastics is foreseen. Research from Wageningen Food and Biobased Research is needed investigating the type of recycled plastic materials available in the market to create packaging systems in a continuous production. Furthermore, due to the need for custom made packaging a modular system, needs to be designed by The faculty of technology of the university of applied science of Amsterdam. This project will reduce the use of virgin wood, find new applications for plastic waste streams and, expand the exploitation of such raw materials, creating added-value to side streams and has a better environmental and social impact.

ChemistryNL

Hyperpolarized Silicon Nanoparticles in Targeted Magnetic Resonance Imaging CHEMIE.PGT.2017.002
Twente University / Spectris Dot

Magnetic Resonance Imaging (MRI) provides excellent anatomical information, but remains unsuccessful in targeted imaging of prostate cancer due to lacking sensitivity. Hyperpolarized MRI has been proposed to improve MR sensitivity, enabling accurate and non-invasive identification of bodily features. Hyperpolarization ensures vastly higher nuclear spin polarization than typically achieved in the magnetic field of an MRI. Dynamic nuclear polarization (DNP), which polarizes samples at temperatures just above 0 K in strong magnetic fields, has become an established technique for the hyperpolarization of materials, resulting in degrees of polarization far beyond thermal equilibrium (factor 104-105). However, the typically employed 13C-based compounds remain only briefly hyperpolarized (MRI visible for only several minutes), hence impeding clinical application.

Powder Coating on Plastics and Composites CHEMIE.PGT.2017.006
Windesheim / DSM Resins / Van Wijhe / FRP3d

Manufacturers are subject to increasingly strict environmental requirements. For example, they are obliged to manufacture an increasing proportion of their vehicles from recycled material. Since many parts and products are made from plastics, there are opportunities here for using recycled materials instead of “virgin” materials. A major disadvantage of recycling plastics is that the color of the end product is difficult to control. Plastic parts are therefore often sprayed with a wet paint. However, applying a powder coating is many times more efficient than using spray paints. Compared to spray coatings, very little material is wasted during the powder coating process. In addition, the process is faster, as a single layer provides sufficient protection and optical enhancement. In addition, the powder coating is emission-free and the coating does not have to dry any further after a curing process and the product is immediately ready for use, storage or transport. Also within the composite industry, especially the unsaturated polyester (UPR) industry, limiting emissions is one of the biggest targets. At the moment, the colored outer layers of composite are realized by using a gelcoat or topcoat, but the application and curing of this creates a peak load in emissions. By further developing the powder coating technique as an alternative to a gel coat, the thermoset industry can take a major step in making the production process more sustainable. The main question of this study will be to enable powder coating on UPR and epoxy thermoset composite (with glass and carbon fibres) after demoulding.

Dynamic Polymer Materials for Additive Manufacturing CHEMIE.PGT.2020.013
Eindhoven University / Maastricht University / DSM / TNO / Xillox Medical / Brightlands Materials Center

3D printing makes it possible to create complex personalized products such as prostheses and implants directly from a 3D scan. To enable these types of applications, it is important that available materials have the correct mechanical and biochemical properties. The awarded project focuses on the development of new polymeric materials and hydrogels based on dynamic chemical bonds that make the materials respond to different conditions during processing. This allows optimal properties of the 3D printed product to be obtained. In addition, end products can also be made with switchable properties.

Hyperpolarized Silicon Nanoparticles in Targeted Magnetic Resonance Imaging CHEMIE.PGT.2020.013
Eindhoven University / Twente University / Spectris Dot

Magnetic Resonance Imaging (MRI) provides excellent anatomical information, but remains unsuccessful in targeted imaging of prostate cancer due to lacking sensitivity. Hyperpolarized MRI has been proposed to improve MR sensitivity, enabling accurate and non-invasive identification of bodily features. Hyperpolarization polarizes samples at temperatures just above 0 K in strong magnetic fields, resulting in

degrees of polarization far beyond thermal equilibrium (factor 104-105). However, the typically employed 13C-based compounds remain only briefly hyperpolarized (MRI visible for only a minute), hence impeding clinical application.

Call for Proposals Technology Areas Polyolefins en Coatings technology CHEMIE.PGT.2018.001
DPI

Focus Areas of the present Call for Proposals for Polyolefins
Key issues in Catalysis, Reaction Engineering, Processing and Properties and their interrelationships. Proposals with embryonic breakthrough research including new experimental approaches, e.g. (multi-scale) modelling and new analytical methods, will be favoured. The final portfolio of granted projects will reflect the strategic interests of the industrial partners related to sustainable developments with respect to energy and feed stock efficiency, environmental impact and overall reduction of footprint.; Focus Areas of the present Call for Proposals for Coatings Technology The industrial funding partners in the DPI Coatings Technology Area are looking forward to project proposals focusing on the following research themes:
• Understanding film-formation phenomena in waterborne coatings
• Self-dispersible bio renewable alternatives for water-based coatings systems
• Phase stability, dynamics, and structure of binary aqueous polymer dispersions

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Nanostructured self-assembled functonal materials CHEMIE.PJT.2017.012
Groningen University

The key objective of this proposal is to develop novel concepts based on self-assembly for tailoring, at the nanoscale, nanostructured materials to provide superior levels of performance or additional features and added value compared to existing materials. In this industrial partnership programme of five universities and six industrial partners we will jointly develop and employ self-assembly at the scale of one to a few hundred nanometers to build diverse classes of hierarchically structured solids and thin-films, using a variety of building blocks including crystallizing molecules, colloids, phase-separating polymers, and (sol-gel) precursors. We aim to investigate and expand the potential in the entire range of 2D to 3D materials: from 2D materials such as single molecular layers of organic coatings deposited on silica particles, to make them directly compatible with rubber tires and advanced polymer brushes for corrosion protection and self-healing, non-adhesive surfaces) via thin assembled designer semiconductor coatings based on functional block copolymers, to 3D biomimetic self-assembled inorganic materials for novel nanostructured thin films that can add new functionalities to surfaces, e.g. those involved in light management in photovoltaic modules. The industrial interest, confirmed by the involvement of several companies in the proposed IPP consortium, is a proof that industry looks further ahead than the immediate application and is ready to explore a new generation of nanomaterials for device applications entering the markets in the next decade.

ReoSim, “Modelling and simulation of the rheology of interfaces” CHEMIE.PGT.2019.003
Eindhoven University / DSM

Various materials consist of a liquid phase that is dispersed in another: soft high interface materials (SHIM), which form the basis of many industrial products and products such as care and food. It is common practice that trade-offs are made between different material properties in the product formation process of these materials. In addition, the choice of stabilizers and processes is often based on experimental methods. Desired properties for the processability or performance of the final product are: the amount of the dispersed phase and the rheological properties of the interface layer. An integrated approach is needed with theoretical and numerical models to link molecular structure and properties of SHIM and the influence of the product formation process on this. It is not yet known how the stability and mechanical properties of

interfaces can be controlled. The aim of this project is to study the quantitative relationship between interphase rheology and structural properties of gas bubbles and droplets in emulsions and foams, as well as the individual and joint mechanical behavior of gas bubbles and droplets. To this end, new numerical methods will be developed to quantitatively predict the behavior of SHIM. This will make it possible to obtain guidelines for the design of these materials to influence their structure (e.g. the liquid fraction of a foam or the distribution of droplet size in an emulsion and mechanical properties. In this way it is expected to gain insight into the factors that influence the performance of the final product.

Closing the loop of the Electrochemical Machining Process CHEMIE.PGT.2018.004
Groningen University

Electrochemical machining (ECM) is regarded as a technology with great untapped potential for machining metal products with fine and complex details. During the process, the workpiece (anode) is locally dissolved by means of an electric current and a salt solution (electrolyte) until it reaches the desired shape, which is arranged as an inverted shape (negative) in the electrode (cathode). However, the metal residues and metal hydroxides produced by this method lead to complications in the reuse of the valuable metals, resulting in large amounts of sludge, increasing costs and environmental problems. Currently, the chemical waste is discharged into a landfill; in total about 220 tons per year (costs €0.16/kg). A possible alternative is the removal of the material to a German mine where it is used for refilling (costs €0.37/kg). It is legally considered a recovery operation and is therefore marked as a recycling stream. However, it is not a very elegant solution in terms of circularity of materials and should be avoided. There is still too much unknown about the concentration, in combination with the appearance, of the metal and metal compounds on which to base the choice of a suitable removal and/or recovery technology. In this project we will focus on the design of a process in which metal hydroxides or the metals and the salt are reused in a circular materials model. We will find the best option for this process, which can actually be a combination of different chemical/physical principles. The process will be assessed with regard to its environmental impacts based on an LCA analysis.

Two-dimensional semiconductors for highly efficient ultrathin photovoltaics CHEMIE.PJT.2018.004
Delft University / Amsterdam University /Toyota

Within this project, the partners are developing new materials and designs for super-thin, light, bendable and inexpensive to produce high-efficiency solar cells. These solar cells are intended for use on surfaces with limited space, which are not straight, or which should be able to move flexibly. For example, think of the outside of an electric car. The researchers adapt recently discovered promising materials in such a way that these capture as many colors of sunlight as possible and efficiently convert them into electricity. They will show how to make a well-functioning, thin, flexible solar cell from these materials with the highest possible energy yield.

Fundamental understanding to improve halide electrolytes for solid-state batteries CHEMIE.PJT.2021.02
Delft University / Saint-Gobain Recherche Paris

The urgency posed by global warming to transform our fossil fuel-dependent society into one based on renewable energy sources creates grand scientific and technological challenges, one of them being energy storage. Batteries are seen as essential to force a breakthrough in the associated revolution towards zero emission transport technology, however, a huge improvement in battery performance is required to realize wide scale future application in mobility to meet climate goals, especially regarding energy storage density, safety, cycle life and material availability. One of the most promising developments are all-solid-state batteries, where the liquid electrolyte is replaced by a solid electrolyte, taking away the safety risks

associated with the flammable liquid electrolytes. Additionally, the energy density of all-solid state batteries is higher due to the lower amount of packaging, especially if it allows safe application of high capacity Li-metal anodes. The challenges lie in the solid electrolyte, especially its electrochemical stability towards the anode and cathode, which should be combined with a high Li-ion conductivity, low cost and scalable production. In collaboration with a multinational ceramic materials company, which has developed compounds within the promising family of halide solid electrolytes, this project will investigate halides in lab-scale cells, to reveal the performance limiting processes at the atomic scale. Based on this, the structure and composition of the halide electrolyte will be improved, guided by atomistic simulations, aiming at the optimal performances to enable next-gen solid-state batteries for a greener future.

SPEAR - Solid and Polymer Electrolyte Advanced Research CHEMIE.PJT.2018.005
Delft University / Shell Global Solutions International

In current lithium batteries, the electrical current is conducted through liquids. These liquids are toxic and flammable, leading to and safety risks. By replacing the liquid with a solid, many problems can be avoided. This project investigates new lithium-sulfur batteries, which consist entirely of solids. Using a combination of two recently developed techniques, the researchers visualize the transport of the lithium ions in the battery down to the atomic level. With this they develop new strategies to make these batteries work properly. They focus on two combinations of materials that seem promising for making safe and cheap batteries that can store large amounts of energy and last a long time.

Call for Proposals Technology Areas Polyolefins en Performance Polymers CHEMIE.PGT.2018.015
DPI /

Programme Area Performance Polymers (TA PP): Performance Polymers are characterized by outstanding chemical, mechanical and/or physical properties, especially beyond ambient conditions. They are applied as material systems at (cyclic or continuous) load bearing conditions and frequently consist of multi-component mixtures with various polymers, reinforcements and additives. The mission of the Programme Area Performance Polymers is to support research on polymeric systems with enhanced performance by combining Chemistry, Processing and Physics, hence covering the whole chain of knowledge. This leads to a better understanding of the "structure versus performance" relation on all length scales - from molecular structures up to the macroscopic properties. In this way the Performance Polymers programme seeks to create new opportunities to respond to the new sustainability challenges posed to the industrial sectors of automotive (jncl. tires), electronics, oil & natural gas recovery and transport and construction materials.

BPM2 programme CHEMIE.PGT.2018.016
Wageningen Food and Biobased Research / Icopal BV / Stora Enso Oyj

PLA is one of the most attractive biopolymers. It combines a low ecological footprint, with good material properties and biodegradability. Moreover PLA is one of the most affordable biopolymers. Nowadays PLA can be processed via several techniques including film casting, injection moulding and thermoforming making it applicable in several products in the market. However, some inherent properties of PLA have limited its use in commercial extrusion foaming. Within the BPM project ‘FOAMEX’, the participants have taken the production of PLA based extrusion foams to a next level where its applicability in foamed products have become possible. However, for a commercial breakthrough, improvements are still needed with respect to rheology and crystallinity of the proposed formulations and materials. In this project, the formulations and (more important) concepts found during the FOAMEX project will be further optimized in order to make them even more commercially interesting. The optimization of the materials will be focused on the requirements of the market: broad and stable process window, sufficient crystallinity, melt strength and interesting cost

price; Conventional roofing materials are high quality products with a long life, but mainly made from fossil raw materials; like bituminous roofing based on the oil derivative bitumen. The uncertainty of bitumen supply, the by consequence high fluctuations in price, as well as the CO2 footprint motivate to look for alternatives. Therefore, together with Partner A, Partner B started, in 2015, the development of waterproofing roofing material made exclusively from renewable raw materials. The ambition was the development of a 100% bio-based roofing membrane that can be fitted into the existing production-process of partner B and application techniques of roofing, without any compromise on product quality.

Advanced multi-mineral technologies for controlling iron – phytochemical interactions CHEMIE.PJT.2018.006
Amsterdam University / Utrecht University / Unilever / Akzo Nobel Chemicals International

Anemia is a global problem affecting 29% of all fertile women. Iron deficiencies in the diet are the main cause of this. This problem can be (partly) solved by adding iron to foods. However, due to the reactive nature of iron, undesired interactions often take place, especially in foods of vegetable origin. These interactions can lead to discoloration and changes in taste. In this proposal, new iron salts that are stable in food. The approach is inspired by the pink Himalayan salt: a non-reactive salt that contains many other minerals such as iron in addition to table salt.

Soft Advanced Materials CHEMIE.PJT.2019.001
Eindhoven University / Amsterdam University / Groningen University / Twente University / VU Amsterdam / Amolf / Altana / BASF / Corbion / DSM

The Stone Age, the Bronze Age, the Iron Age: throughout history we see time and again that new materials drive technological and social progress. Today we are in the age of plastics, and although these materials have also brought prosperity and convenience to the Netherlands and the rest of the world, the call for better materials is growing. Not only materials that are stronger, lighter, smarter and cheaper, but also materials that are greener – sustainably embedded in natural cycles. In the Soft Advanced Materials programme, Dutch materials researchers from all disciplines join forces with leading industrial partners to make this transition possible.

Dutch Polymer Institute – Programme Area Performance Polymers and Polyolefins call CHEMIE.PGT.2019.016
DPI /

The current Performance Polymers programme covers the following four scientific discipline clusters: -Polymer chemistry, network chemistry and chemical modification of polymers -Polymer processing for properties, polymer physics and modelling; -Advanced reinforced polymer systems and (synthetic) fibres; -Long term stability and performance. The call of the Performance Polymers 2.0 program is focusing on: Surface treatment methods for improved adhesion and tribology of polymers. Advanced surface characterization techniques, Investigation of the mechanism of impact in multi-phased polymeric systems. Modelling and experimental approaches. Preferred topics of new project proposals in this Call for Proposals are: Integrated approaches to molecular olefin polymerization catalyst systems, Advanced molecular characterization of polyolefin materials, Improved approaches to hetero-phasic PP products, Sustainable polyolefins / Circular Economy aspects.

The impact of inhomogeneous electrode reactions on battery cycling CHEMIE.PGT.2020.025
Delft University / Shell Global Solutions International

This project targets a challenging knowledge gap in Li-ion batteries, the role of inhomogeneous redox reactions on the performance of Li-ion batteries. Inhomogeneous reactions refer to the uneven phase transformation and Li-ion distribution in battery electrode materials during operation, which can cause history effects that prevent optimal storage performance and reduce the cycle life of batteries. TU-Delft is uniquely positioned with expertise and capabilities to unravel the fundamental mechanisms that lead to inhomogeneous reactions, via operando measurements of Li battery electrodes. Coupling of experimental data with phase field modeling will result in an in-depth understanding of the distribution of the inhomogeneous redox activity for key electrode materials. The desired outcome from this project is a generalization and quantification of inhomogeneous redox reactions and their relation to history effects and cycle life, and ultimately the project targets the development of methodologies to predict the impact of previous cycles in an effort to enable battery management systems to anticipate optimal charging strategies and lead to novel electrode design strategies.

Towards a circularity in recycling of polyurethanes CHEMIE.PGT.2020.022
Eindhoven University / BASF

Polymers are materials of our present and future which have enabled us to improve the quality of life with significant impact on health care, agricultural production, food and water distribution in more hygienic way. They are essential to create a more sustainable society and develop future technologies such as electric vehicles, drones, intelligent buildings, robotics, electronics, personalized healthcare and diagnostics. However, our lifestyle also generates serious problems due to the ways in which we use plastics. The plastics that we use are thrown away every day, rarely recycled and end up in landfills, rivers and oceans forever, and are a prototypical example of the current linear and fossil-based produce-use-discard value chains leading to environmental pollution. Therefore, a fundamental transition is required in the field of polymeric materials from synthesis out of fossil-based feedstock and one time use to continuous re-use of polymeric products. In this project, researchers from Eindhoven University of Technology will focus on designing novel polymeric structures more amenable to recycling, including smart new monomers that can switch between polymerized and depolymerized states, using energy efficient processes. The key is incorporation of suitable degradable functional groups or smart monomers into the polymers in their design stage. In collaboration with BASF, research will be initiated to increase the share of recycled polymer products, in order to create a circular economy for future business.

Propelling Analysts by Removing Analytical-,Data-,Instrument-, and Sample-related Encumbrances
CHEMIE.PJT.2021.001
Amsterdam University / VU Amsterdam / Netherlands Forensic Institute / Shell Global Solutions Int. / Genentech / DSM Materials Science Center / DSM Coating Resins

Science and society need factual data to be able to make responsible decisions and act. What is the patient suffering from? Is the drug safe? Is this substance an explosive material? Those who make such measurements and who devise new methods of measurement are analytical chemists. The questions posed to analytical chemists are increasingly complex and require highly sophisticated equipment and very smart software. These innovations are being developed in the PARADISE project, in which the University of Amsterdam and the VU University are collaborating with Genentech (a Roche company), Shell, DSM and the Netherlands Forensic Institute. Together in PARADISE on the way to seventh heaven.

ChemistryNL

Dutch Polymer Institute - Programme Area Performance Polymers and Polyolefins DPI 2.0 Call for Research Proposals 2020 CHEMIE.PGT.2021.001

Afgesloten projecten

Self-Synthesizing Hydrogels (SelfSyntHGels) CHEMIE.PJT.2016.05
Groningen University / DPI

Zelf-synthetiserende gel.
Dit onderzoek beoogt de ontwikkeling van nieuwe gelen die zichzelf construeren uit simpele bouwstenen. Het constructieproces kan worden gestuurd zodat de gelen de gewenste structuur en eigenschappen hebben. De onderzoekers willen de resulterende materialen toe gaan passen als media voor het groeien van cellen in drie dimensies.

Supramolecular Biomaterials with Antimicrobial and Regenerative Activity (SuperActive) CHEMIE.PJT.2016.07
Eindhoven University / DPI

SuperActief anti-microbieel materiaal repareert weefsels
Een SuperActief synthetisch biomateriaal wordt ontwikkeld dat weefsels in het lichaam kan repareren. Door gebruik te maken van unieke chemie kan dit materiaal simultaan meerdere functies uitoefenen. Het materiaal wordt zo ontworpen dat het zowel een infectie tegen kan gaan, als dat het weefselvorming kan sturen. Op deze manier is de prognose dat er minder complicaties na implantatie optreden, en dat eén operatie voldoende is om weefsel te herstellen.

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2 Calls for Proposals: Performance Polymers en Polyolefins and Coatings Technology CHEMIE.PGT.2016.009
DPI

The new PP program is focusing on the broad area of polymers at interfaces. Seeked projects should focus on interfaces between polymers and metals, polymers and fibers or polymers and fillers or interfaces between different polymers. For this first call, the DPI seeks in particular projects that develop experimental approaches backed by theoretical guidance (but not modeling projects per se) and the use of advanced or innovative characterization techniques which can provide some understanding. The specific focus of the projects should be on: 1) Detection of local debonding defects at the above mentioned interfaces through the creative use of new or advanced analytical experimental techniques such as but not limited to : NMR, IR microscopy, advanced analytical AFM based techniques or Micro-Raman. Grazing angle X-rays or NEXAFS (Near Edge X-Ray Absorption Fine Structure). These defects could appear because of stress but could also be due to the presence of contamination on the surface prior to bonding. 2) The development of reporter molecules, or broadly speaking new chemistry, that could be used (in combination with other analytical techniques) to broadly detect damage at interfaces. Of particular interest are molecules that are specifically positioned at the interface of interest.

Towards flexible memories with coordination polymers with polar rotors (RotorMOF) CHEMIE.PJT.2016.03
Delft University / DPI

Onderweg naar flexible geheugens met coordinatie polymeren met polaire rotors.
Smartphones die de vorm van je pols volgen of flexibele geïmplanteerde devices die energie kunnen oogsten van je bewegingen. Dat soort innovaties worden mogelijk als er ook adequate geheugens voor worden ontwikkeld. Voor dit doel gaan we coordinatie polymeren ontwikkelen die kleine rotors bevatten die in twee posities gedraaid kunnen door een spanning aan te leggen. De twee verschillende posities vertegenwoordigen opgeslagen informatie.

Development of a Vibrational Optical Activity analysis toolbox from chiroptical spectra to molecular stereochemistry and conformation CHEMIE.PJT.2015.003
Amsterdam University / Scientific Computing & Modelling N.V. / BioTools, Inc.

Chiraliteit speelt een fundamentele rol bij de bepaling van de chemische en biologische activiteit van moleculaire systemen. In de afgelopen jaren is de theoretische beschrijving en de experimentele aanpak van spectroscopische technieken om de stereochemie van chirale moleculen te bepalen sterk verbeterd. In dit project worden deze verbeteringen geïntegreerd tot een gebruikersvriendelijk analytisch instrument. Hierdoor worden de mogelijkheden van industrieel onderzoek aan chirale moleculen flink uitgebreid.

Responsive Commodity Polymers (ReCoPol) CHEMIE.PJT.2016.02
Eindhoven University / DPI

Polymeren worden slim. Slimme materialen worden ontwikkeld op basis van conventionele, georiënteerde polymeren die reageren op omgevingsomstandigheden. Het onderzoek richt zich op polymeren die zich aanpassen aan omgevingsomstandigheden zoals temperatuur, luchtvochtigheid en licht door van kleur en/of vorm te veranderen. Zelf-organiserende responsieve polymeren worden gebruikt in combinatie met nano- en microstructuren om de slimme eigenschappen te verkrijgen in deze bulk polymeren materialen. Verwacht wordt dat de ontwikkelde materialen goedkoop en op grote schaal vervaardigd kunnen worden en dat er toepassingen gevonden zullen worden in bijvoorbeeld slimme kleding, robotica, sensoren en medische toepassingen.

Rock-on-a-Chip: Salt-controlled wettability alteration in oil-water-solid systems for applications in enhanced oil recovery CHEMIE.PJT.2015.002

Stichting FOM / BP International Centre
Oil recovery is a complex process involving physical and chemical phenomena at multiple length scales ranging from molecular dimensions to the macroscopic extensions of an oil field. State-of-the-art water flooding technology using sea water is able to recover only 30-50% of the oil that is originally present in the reservoir. A substantial fraction of the residual oil remains trapped in microscopic pores due to the strong adhesion and wettability of crude oil on the reservoir rock. The purpose of the present program is to obtain a fundamental understanding of salt-mediated wetting alteration in sandstone-based oil reservoirs by performing experiments with well-defined model systems, starting from idealized solid and fluid compositions and gradually evolving towards more complex systems.

ChemistryNL

Photonic supralatices for pigment-free colour in waterbased coatings (SUPRALATICE) CHEMIE.PJT.2016.01
Wageningen University / DPI

Paint colors without pigment
Paints are traditionally colored with pigments, which gradually fade with exposure to light. Nature has a smarter strategy, where precise nanostructures, for example, butterfly wings and peacock feathers give their intense and never-fading color. In this project, the researchers will introduce naturally inspired, pigment-free, coloring methodology in sustainable, water-based, to paint.

The interaction of sustainable aqueous coating solvents with electrode materials, enabling next generation high energy densitt Li-ion batteries CHEMIE.PJT.2017.010
Delft University / Toyota

Future Li-ion batteries require higher energy densities and power densities to enable electrical transport. At the same time material production costs need to be reduced and production methods should become environmentally benign. This project investigates a novel environmentally benign coating strategy of a Li-F thin film, the large electrochemical stability of which enables the use of potential positive materials in Li-ion batteries to increase their energy density. These coatings are vital for the protection of the high potential of these future electrode materials towards the electrolyte, thereby preventing battery degradation. However, it is unknown how the aqueous solvent used for the coating interacts chemically with the surface and bulk of the electrode materials. Because the coating strategy leads to an increase in Li-ion battery resistance, fundamental understanding of this interaction is paramount. This project aims at detailed understanding of the surface and bulk chemistry as a consequence of the aqueous solvent coating route. This will be achieved by atomic scale characterization of the surface and the bulk of the electrode materials utilizing the specific sensitivity towards the involved species, protons and Li-ions, of neutron scattering techniques and Nuclear Magnetic Resonance. With this fundamental experimental approach, the project aims at finding the origin of the observed increase in resistance. This will form the basis for future rational coating strategies for high performance next generation Li-ion batteries.

Synthesis of Polymers for Healthcare applications CHEMIE.PJT.2016.06
Maastricht University / Tejin

Ultra-High Molecular Weight Polyethylene (UHMWPE) is one of the most commonly used polymers for the production of prostheses. The polymer can be synthesized using monomers from fossil base as well as bio-based sources such as bio-ethanol. With the advances in polymer chemistry, and our understanding of molecular control for ultimate mechanical properties, in this proposal we will address synthesis routes for development of the next generation of polymers by controlling morphology to achieve the ultimate mechanical properties, while maintaining the same molecular configuration. The adopted approach will overcome the existing problem of sintering in UHMWPE that reduces the life time of prostheses, whereas the number-average molar mass greater than a million g/mol will reduce the adhesive wear thus increasing the life time of hip-prosthesis.
