ChemistryNL

Toegekende projecten Chemical Conversion, Process Technology & Synthesis

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Lopende projecten

Bifunctional zeolite catalyst for selective hydrocarbon conversion CHEMIE.PGT.2017.007
Utrecht University

Overall goal: Scientific understanding and technical utilization of nanoscale effects in bifunctional catalysis for hydro-isomerization of n-alkanes using zeolite-based catalysts.

New insights in the working principles of tri-ethyl boron as co-catalyst in Cr/SiO2 Phillips catalysis CHEMIE.PGT.2017.008
Utrecht University / Philips

Phillips katalysatoren zijn erg belangrijk in de chemische industrie omdat ze gebruikt worden om plastics, zoals polyetheen, te maken. De eigenschappen van deze plastics worden niet enkel bepaald door de preciese samenstelling van de polymerisatiekatalysator, maar ook door de manier waarop de katalysatormaterialen geactiveerd worden. In dit onderzoeksproject wordt fundamenteel nieuw inzicht verworven hoe een boor-houdende component invloed heeft op oppervlakte chroom atomen, die de actieve fase van een Phillips-type katalysator vormen. Hiertoe worden een aantal geavanceerde karakteriseringstechnieken gebruikt, waaronder Röntgen microscopie.

Bio-based rheology modifiers for coatings CHEMIE.PGT.2017.009
Delft University

Organic rheology modifiers for solvent based coatings are superior to inorganic rheology modifiers with respect to coating production, application and appearance, and moreover, they have the advantage that they are biodegradable and can be produced from renewable resources. These organic rheology modifiers are made by a self-assembly process of organic molecules into organic fibrous dispersions, which involves the lengthy and energy-consuming thermal annealing of semi-crystalline powder into crystalline fibers, requiring narrow process conditions. This tedious fabrication process under stringent conditions severely limits adaptation to specific applications and customer requests, and also enforce centralized production of the fibrous dispersions to guarantee product quality. The objective of this project is to develop a new approach for a scalable and local production of fibrous dispersions as rheology modifier from biomass feedstock, while preserving the rheological profile of the product. We propose to formulate and produce organic powders with a glassy, amorphous state, by orthogonal self-assembly of partially incompatible components that are readily synthesized from biomass feedstock. Solvent assisted annealing of these multicomponent amorphous powders is expected to be a spontaneous process and will lead directly to interpenetrating networks of different fibrous assemblies, each formed from one of the components. The annealing of amorphous powder into crystalline fiber dispersions will be facilitated thermodynamics and kinetics, thus allowing for a faster, more robust, and more flexible production process.

Moreover, the rheological performance of multicomponent fibrous dispersions surpasses those of single fibrous dispersions, while the multiple component nature offers greater freedom for formulation.

Innovation by Product and Process Design: For life sciences & health, energy conversion & storage, circular economy CHEMIE.PGT.2017.009
Delft University

Process design methodology and tools have been successfully applied to strengthen the innovation power and commercial success of the Dutch (bio)chemical process industries. Coupled with world-class research the combination of design and research can quickly lead to the most promising candidates that ultimately make it to a success. In that context, University two-year post-MSc PDEng programmes have been successful in educating and training top-level MSc graduates to top-designers for positions in companies, where they contribute in the key phases of process innovation, especially in the oil & gas, bulk and specialty chemicals and environmental processes. PDEng cooperation projects between University and industrial partners are a perfect way to use the latest knowledge in designing and developing novel products and processes, to recruit, train and educate (international) top talent and provide them with employment in the innovative sectors in Dutch industry. Design of products and the design of processes for the life sciences, health, energy conversion & storage and products has had less of attention. It is in these areas where product and process innovations and the innovation power of the Dutch industries can be further strengthened.

Development Electrochemical Cleaning Washing water Flue gases CHEMIE.PGT.2017.018
ECN

As part of the wet chemical cleaning of flue gases, flue gases are passed through a gas scrubber. Acidic components are washed from the flue gases, and the acidic wash water is neutralized with strongly alkaline raw materials. The resulting residue consists of a filter cake consisting mainly of gypsum and which is heavily contaminated. This filter cake is dumped in the Netherlands. The leftover treated water contains a lot of salt and should not be discharged. In close collaboration between a knowledge institute and industry, an innovative membrane electrolysis (ME) process is being developed that makes it possible to recover hydrochloric acid (HCl) from salt evaporation water, while also significantly reducing the consumption of alkaline raw materials. The development of the innovative recovery process is divided into four phases: (1) proof of principle testing of the method in a laboratory setting; (2) on-site test set-up; (3) small scale, full treatment; (4) full scale, full treatment. As a result of the results of the 'proof of principle' carried out in the first phase, a number of fundamental factors must be further investigated on a laboratory scale, the process design must be adjusted and tested in a pilot set-up to be developed and built.

Syncat at DIFFER: Electricity to Chemistry, Catalysis for Energy Storage CHEMIE.PJT.2016.04
DIFFER / Eindhoven University / Syngaschem BV

Driving on sunlight: making fuel from electricity, water and CO2 Due to the rapid growth of 'green' electricity production, there is a need to develop chemical processes that use electricity instead of fossil fuels. For example in the storage of the temporary power surpluses inherent in fluctuating energy sources such as wind turbines and solar panels, in the form of solar fuel. This process of converting electricity, water and CO2 to petrol making is based on electrochemistry or plasma chemistry in combination with catalysis, because at every step a good catalyst is indispensable. Optimization of catalyst materials requires detail understanding of surface processes involved. The Dutch Institute for Fundamental energy research DIFFER, the department of applied physics of Eindhoven University of Technology and the research company Syngaschem BV join forces in the field of electrochemistry, catalysis, surface reactions, spectroscopy and plasma physics to efficiently handle green energy into liquid hydrocarbon mixtures with a high energy density.

Enzymatic Depolymerization of (synthetic) Polymers (EnDeP) CHEMIE.PGT.2020.020
Amsterdam University / DSM / InnoSyn

The accumulation of plastic materials in the environment and their efficient recycling are essential challenges of contemporary society. Therefore, academia and industry have made significant efforts over the past decade to develop new plastic materials that are inherently degradable in the environment. However, replacing traditional plastic materials with new generation biodegradable alternatives is not always possible. In fact, there are technical applications where conventional polymers still provide superior performance that is mandatory. However, it seems that the degradability of these traditional polymers can be tuned as this is also related to their specific physicochemical and structural properties. Surprisingly, the performance properties of these polymers relative to degradability have not been fully elucidated. Therefore, this project will develop novel biocatalysts (i.e. enzymes) for the selective (i.e. "chemically controlled") degradation of polymeric materials, and will provide advanced analytical techniques for determining key factors influencing polymer degradability. This research will thus contribute to the generation of the required knowledge to understand the process of depolymerization of synthetic polymers and will provide a toolbox of biocatalysts that can be used for efficient plastic recycling, for bioremediation and as a tool in the analytical chemistry of polymers.

Spatiotemporal Operando Characterization of Coke Deposits, Metal Dispersion and Temperature within Light Alkane Dehydrogenation Catalysts CHEMIE.PGT.2021.006
Utrecht University / BASF

Propane dehydrogenation catalysts are essential for making propylene, one of the most important building blocks in the chemical industry. Due to the increasing economic importance of propene, the catalytic systems for propane dehydrogenation have been much researched. However, this catalyst is not yet fully understood. This lack of insight is caused by a number of aspects. One of these is the changes in the active sites due to carbon deposits and as a result of the regeneration treatment. For the further development of this important process and the creation of better and more efficient catalysts, it is necessary to expand our understanding of the dynamics of the catalyst during propane dehydrogenation and regeneration under relevant industrial reaction conditions. With the development of more advanced time-dependent micro-(spectro-)scopic techniques, it becomes possible to put the catalyst under a magnifying glass. The aim of this research project is to apply a new form of Raman spectroscopy in heterogeneous catalysis. The so-called time-gated Raman spectroscopy makes it possible to distinguish the Raman signal from the fluorescence signal by measuring very quickly. The latter is often responsible for the inability to (properly) analyze carbon deposits in heterogeneous catalysts. In this project, operando time-gated Raman spectroscopy is used to analyze the carbon deposits during dehydrogenation-regeneration cycles in the reactor bed of Pt-Sn/Al2O3 catalysts. This will lead to (a) new insights into the specific role of metal (Pt), promoter (Sn) and carrier material (Al2O3); and (2) experience in how operando time-gated Raman spectroscopy can be used to study other catalysts that possess intrinsic fluorescence, such as zeolites.

Bimetallic Catalysts for Hydroformylation CHEMIE.PGT.2021.013
Utrecht University / Total

Catalysts for new conversion pathsIt is crucial to become less dependent on fossil energy sources for our fuels and raw materials for the chemical industry. The search is for alternative paths in which, for example, smaller molecules can be linked together in a targeted manner to make the desired longer molecules with oxygen atoms, which are currently still traditionally made from petroleum. Researchers from Utrecht University, in collaboration with TOTAL, will devise, make and test new catalysts to make these conversions possible.

Promoter and poison effects in heterogeneous catalysis: Novel tools to shed fundamental insight CHEMIE.PJT.2017.011
Leiden University / Utrecht University / Shell Global Solutions Int. / Leiden Probe Microscopy / DSM

Many characterization techniques used in catalytic studies cannot perform at the conditions of the chemical industry (i.e. high pressures and temperatures). Hence, new technologies need to be developed to study the structure-activity relationship of heterogeneous catalysts under these conditions. We willdevelop two novel technologies.One is the development of operando scanning probe microscopy integrated with a flow reactor. Toovercome the major drawback of limitation to either STM or AFM, we will develop an instrument in which both techniques can be used simultaneously, thereby combining the structural information of AFM with the electronic structure information of STM. In addition to obtaining structural information of the catalyst surface, chemical information about all species present at the surface is very valuable. Vibrational techniques as infrared and Raman spectroscopy are able to do this. However, their resolution is currently limited to the (sub)micrometer scale whereas STM and AFM give topological information on the nanoscale. Therefore, we will develop infrared and Raman spectroscopy able to provide chemical information on the nanoscale under industrial conditions. The industrially relevant reaction we will investigate is Fischer-Tropsch synthesis, i.e. the production of hydrocarbons from hydrogen and carbon monoxide, thereby creating clean transportation fuels. The interaction between the catalyst surface and the reactants plays a crucial role in the local morphology and chemical composition of the catalyst, which is relevant for its activity, selectivity, and stability. Being able to follow how the reactants influence the morphology and chemical composition allows for catalyst improvement by rational design.

Benign and Circular by Design – Sustainable Organophosphates CHEMIE.PGT.2022.003
Amsterdam University / Susphos

Phosphorus is essential for life on Earth and plays a prominent role in modern science and technology, where organophosphorus compounds are of immense importance for their wide-ranging applications in material science, nanotechnology and life sciences. At present, however, the overall industrial processes to produce these phosphorus compounds are unsustainable, energy intensive, and inefficient. Additionally, many organophosphorus chemicals are found in the environment, contributing to ever-growing chemical pollution. To meet the growing demand for phosphorus compounds with high functionalities, whilst addressing pressing sustainability issues and complying with increasingly stringent environmental regulations, we will develop environmentally benign and circular organophosphates with enhanced biodegradability by bringing together sustainable synthesis and design, with a key focus on lowering environmental impacts. Thereby, we help to align the societal benefits of chemicals with ecosystem integrity. Our interdisciplinary approach exploits facets of (in)organic, computational and environmental chemistry, with an emphasis on synthesis, molecular design, environmental impact assessment, and biodegradability. In this project, we will develop a computer-aided framework for the design of benign chemicals, making use of state-of-the-art predictive models and innovative experimental assessment techniques for environmentally relevant properties. Simultaneously, we will advance the eco-friendly production of benign organophosphates using waste phosphates as renewable feedstock, which will prevent their constant spillage in the environment. We will implement these innovations into a broader context and develop scalable protocols, which are needed to realize safe and sustainable phosphorus chemistry on a large scale, introducing systematic and targeted molecular design, as well as recycling, clean, and 'cradle-to-cradle' technologies as ground-breaking changes in the field to ensure the continued beneficial use of phosphorus, in particular as sustainable flame-retardant additives for textiles.

Towards zero-emission processes in microbial biotechnology CHEMIE.PGT.2021.003
Delft Unisity / DSM

Micro-organisms are widely used in the biotechnology industry. In large-scale processes, they make a wide range of products such as transport fuels, medicines and food ingredients from renewable raw materials such as sugars from agricultural crops. In these processes, part of the sugars supplied is converted by the micro-organisms into CO2 to meet their energy needs. This collaboration project between TU Delft and DSM focuses on developing new technology and new industrial micro-organisms to avoid these CO2 emissions in biotechnological processes by "feeding" micro-organisms with sustainably generated electricity ("green electricity"). . Electricity is first used to catalytically convert the produced CO2 into simple chemical compounds ("electron carriers"), which can be used by micro-organisms as a source of energy. By subsequently feeding these electron carriers back into the biotechnological processes, we can both reduce the amount of sugar required and reduce net CO2 emissions to zero. The research in this project includes selection, characterization and optimization of micro-organisms and biotechnological processes, both for the production of suitable electron carriers and for the efficient use of mixtures of sugars and electron carriers. Research will be conducted into bacteria that grow directly on electrodes and thereby make electron carriers from CO2.

INTERACT" (Interface Catalysis for Advanced Sustainable Chemistry) CHEMIE.PJT.2020.001
Eindhoven University / Johnson Matthey Technology Centre

Catalysts are essential materials used in the conversion of fossil and renewable energy sources and raw materials into energy carriers, fuels, chemical building blocks and materials. By accelerating the conversion of reactants into a desired product on their outer surface, catalysts allow us to store electrical energy in chemical bonds, convert alternative hydrocarbon sources such as methane into chemical building blocks, and convert harmful substances into clean air. Many of these catalysts contain transition metals, the worldwide supply of which is limited or which are only mined in certain parts of the world. Since catalysis takes place at the surface of metals, it is advantageous to make the metal phase as small as possible. The ideal catalyst consists of individual metal atoms that must then be stabilized on the surface of a support material. In this project, the researchers will specifically look at how the smallest possible metal clusters or metal atoms can be stabilized on carrier materials such as cerium dioxide and zeolites. Due to the high dispersion, the interface with the support plays a major role in the catalysis. This is still little understood and creates new possibilities for, for example, designing more thermally stable catalysts or accelerating new catalytic reactions. The project combines questions from Johnson Matthey's practice on more efficient catalysts for environmental catalysis, renewable energy storage and selective oxidation with the knowledge and skills of Eindhoven University of Technology to characterize these metal-support interfaces using advanced spectroscopic techniques. The focus is on so-called operando spectroscopy, in which the catalysts are studied during the chemical reaction. These insights will lead to new design rules for a next generation of supported catalysts with high activity and selectivity in which metal consumption can be minimized.

Bubble Dynamics in Electrolysis CHEMIE.PJT.2019.003
Eindhoven University / Delft University / Twente University / Shell / AkzoNobel

Efficient processes for converting renewable electrical energy into hydrogen are crucial for realizing the energy transition. Large-scale production of hydrogen is possible by using water by means of water. electrolysis into hydrogen and oxygen. However, electrolysis has a low efficiency which is closely related to the flow and transport phenomena near electrodes, especially around the hydrogen bubbles formed. In this project, researchers study the formation of hydrogen bubbles, the transport of chemical substances near the bubbles and the electrodes and the interaction between bubbles. The insights from the research can be used by the industrial companies involved to make their electrolysis processes much more efficient.

Industrial dense granular flows CHEMIE.PJT.2020.001
Delft University / Twente University / Eindhoven University / SABIC / Shell / Tata Steel / Tejin Aramid bv

This research focuses on the development of experimentally validated models for the description of dense granular flows that are common in industrial physical and chemical processes. The emphasis is on studying complex granular systems where the particles are complex possess characteristics (shape, dimensions) and/or exhibit complex mutual interactions. For the experimental research uses a variety of advanced non-invasive measurement techniques.

Intensified ammonia synthesis as e-fuel CHEMIE.PGT.2021.004
Eindhoven University / ENGIE

The use of ammonia as renewable fuel has been long discussed in scientific literature, but it is now gaining increasing momentum. To enable the use of ammonia as a carbon-free e-fuel, more cost-efficient and resource-effective production and utilization should be developed through process intensification strategies. In order to make the possibility of ammonia fuel a reality, the project will be devoted to develop, integrate and prove at TRL4 key game changing catalysts, membrane and reactors to enable the flexible and profitable production of e-ammonia. From the technological standpoint, this is done developing advanced materials (Catalysts and Membranes) and their combination in a compact reactor with optimized heat management for a more cost-efficient and resource-effective e-ammonia synthesis from renewable energy, through production of ammonia at lower temperatures and pressures compared to conventional systems. Green ammonia will be produced at lower temperatures and pressures than by conventional Haber-Bosch process by the development of new catalytic materials allowing ammonia synthesis at mild operation conditions and by the development of membrane materials that selectively separate ammonia from the reaction mixture further supporting higher ammonia production.

Transforming carbon-rich industrial waste gases of metallurgical plants into valuable products (TRANSCRIPT)
Utrecht University / Leiden University / Tata Steel / M2i

With a CO_2 reduction of more than 50% compared to the conventional blast furnace process, it has recently become HIsarna process developed an important step forward in Tata Steel's ambition of a fully carbon neutral steel production. The use of the HIsarna top gas is central to this consortium. Tata Steel, Utrecht University, Leiden University and M2i have joined forces to pass thermoen electrochemical way to convert the high temperature CO_2-rich emissions of the HIsarna top gas in valuable base chemicals. In addition to new catalytic converters, new thermo- and electrochemical measurement methods are being developed, hich are generically applicable in the broad field of catalysis and process technology.

Automatic design optimization of process equipment for chemically reacting flows CHEMIE.PGT.2021.016
Eindhoven University / Bosch Thermotechniek B.V.

In order to decarbonize the chemical process industry, novel hydrogen-based technologies for heat and power are necessary. The optimization of a design given certain goals and constraints like optimizing chemical conversion while minimizing undesirable pollutants can be very challenging, especially when the goals are competing and the constraints are very limiting. The Adjoint Computational Fluid Dynamics method is a computational tool that augments traditional computer simulations by providing a geometry sensitivity analysis for user-defined objectives. With this information, designs can be optimized to maximize chemical conversion or heat exchange, while at the same time minimizing unwanted reaction products, system pressure drop or temperature peaks. The application of such design optimization methods to chemically reacting flows is a very new research field and has only recently been investigated in proof-of-concept studies by Bosch [1]. To make this method suitable for design optimization in an industrial engineering environment, manufacturability needs to be accounted for. The goal of the project is I) to develop a digital twin simulation environment for automatic design optimization of industrial sized appliances that include chemical reactions, II) to implement a design for robustness workflow where the sensitivity of the main design objectives to geometric changes is investigated and III) to develop robust hydrogen for heating appliances with ultralow NOx emission (< 1 ppm) within this environment. To achieve this, a robust, accurate and fast design tool will be developed that can automatically improve an existing design and optimize multiple design goals simultaneously like optimization of specific reaction products and heat transfer efficiency.

ChemistryNL

Afgesloten projecten

Understanding the physicochemical interactions between phosphate and the active sites within zeolite ZSM-5 with the aim to boost the propylene production in fluid catalytic cracking TKINCI.2015.0005
Utrecht University / Albemarle

The aim of the research project is to study the role of phosphorus in the activation and stabilization of zeolite ZSM-5. This zeolite material is used to make more propylene in the oil refinery, so as to reduce the rising to continue to meet the demand for polypropylene. Previous research at the UU has already important information, but the important fundamental questions about the exact structures in the pores of the zeolite have not yet been answered. Researchers will try to solve this problem unloading through a combination of advanced spectroscopic techniques, computer modeling and catalytic cracking tests.

CatchBio 4e fase (deelprojecten 053.70.441 t/m 053.70.444) (PGT 2013+2014) TKINCI.2015.007
Utrecht University / CatchBio

I CatchBio: characterization of different lignin fractions and determine the most suitable characterization technique. II CatchBio: characterization of lignin from different resources and determine composition in different fractions. III CatchBio: process design aspects for lignin conversion. IV CatchBio: catalytic hydrogenation of biomass derived platform molecules.

Transition-metal catalyzed epimerization-free peptide C-terminal activation and fragment coupling TKINCI.2015.006.1
Amsterdam University / ENZYPEP

Non-oxidative Coupling of Methane via Plasma Catalysis TKINCI.2015.0002
Twente University / DIFFER / Sasol

From natural gas to plastic; an old dream attainable with new technology? Making plastics such as polyethylene (plastic bags, and much more) from cheap natural gas? The technology is here but is rather cumbersome and expensive because it has to be done in a detour. Therefore, single step process long-cherished wish, but despite all efforts, that does not work enough to be able to start a factory to build. This project will answer the question whether a combination of plasma chemistry and catalysis solution.

Structure sensitivity of supported nickel catalysts for (de)hydrogenation of alkanes and alkenes TKINCI.2015.0003
Eindhoven University / Utrecht University / BASF

Catalysts are essential for the chemical industry, for example to valorize natural gas to all kinds of useful intermediate and end products. Normally, the smaller the particles are, the greater their surface area and the more active they are as catalysts. However, such particles get special properties if they get smaller than about 10 nanometers. To better catalytic converters to develop for the future it is necessary to understand exactly how the catalytic behavior depends on the size of the nanoparticles.

Design of heterogeneous catalysts for chemo-selective synthesis of cyclohexylamines (Catamine)
CHEMIE.PGT.2016.002
Amsterdam University / DSM

Amines are an important class of compounds that can be used as intermediates for pharmaceuticals, agricultural adjuvants, rubbers, water treatment chemicals and solvents. Cyclohexylamines are a relevant part of the amine family that forms the basis of anticonvulsants, kinase inhibitors, antidiabetics and antiviral compounds. They are generally produced via two routes, the main one being via hydrogenation of aniline using cobalt or nickel catalysts. This process requires a high temperature and a high pressure, large amounts of non-recyclable catalyst and finally has a low efficiency. The aim of this project is to investigate new catalysts that can be used to make cyclohexylamines with high efficiency and under mild conditions (low temperature and pressure). The new catalyst will also be easy to separate from the reaction mixture and can therefore be easily reused.

A holistic catalysis and reaction engineering approach to methane dehydroaromatization into chemicals
CHEMIE.PJT.2015.001
Eindhoven University / Delft University / SABIC

Natural gas, the cleanest of fossil fuels, will play a major role in the coming decades in our energy supply. In addition, it is important to extract from natural gas in an economical way to make aromatics. This project develops optimal catalysts for new reactor concepts which should enable the direct conversion of natural gas into benzene.

Metal Initiators for Controlled Emulsion Polymerization (MI-CEP) CHEMIE.PGT.2016.005
Utrecht University

Radical polymerization is a widely used method to make important plastics, resins and other high molecular weight substances. The steering of this reaction and thereby control over the material properties of the product however, leaves a lot to be desired in many cases. This has to do with the high reactivity of the growing polymer chain resulting in unwanted termination reactions. In this project, an attempt is made to use metal compounds to to stabilize growing polymer chains in such a way that termination reaction has no chance and allow precise control over molecular weight. The intended good control of the polymerization process makes it possible to materials with better properties.

Modeling Ion Diffusion during Preparation to Improve Catalyst Selectivity (MIDPICS) CHEMIE.PGT.2016.006
Utrecht University / Inovyn

Improving Industrial Catalysts through Fundamental Models
Utrecht University and Inovyn will collaborate to potentially improve the preparation of an industrial catalyst by using fundamental models on an atomic scale. Vinyl chloride monomer (VCM), the raw material for polyvinyl chloride (PVC), is produced by, among other things, oxychlorination of ethylene. This reaction is catalyzed by copper chloride and has a high selectivity. Nevertheless, an even higher selectivity is an important goal of research on this reaction, due to the enormous size of the worldwide PVC production. This project is based on an idea to improve this selectivity through a specific change of the nanoscopic structure of the catalyst, which could be achieved by modifying the preparation. By means of fundamental models on this scale, the mobility of the ions concerned will be studied under different conditions.

With this in-depth knowledge, an improved recipe for the catalyst preparation will then be drawn up and finally the effect on the selectivity will be tested in the industrial lab. The knowledge gained in this project can also contribute to solving other technical aspects of this reaction. In addition, the concept of applying fundamental models at the atomic scale to the subtle processes during preparation of catalysts and thereby improve real industrial catalysts of great scientific interest.

New Insights in the Working Principles of tri-ethyl boron as co-catalyst in Cr/SiO2 Phillips catalysis
CHEMIE.PGT.2016.008
Utrecht University /Philips

Phillips catalysts are very important in the chemical industry because they are used to make plastics, such as polyethylene. The properties of these plastics are not only determined by the precise composition of the polymerization catalyst, but also by the way in which the catalyst materials are activated. In this research project, fundamental new insight is gained into how a boron-containing component influences surface chromium atoms, which form the active phase of a Phillips-type catalyst. To this end, a number of advanced characterization techniques are used, including X-ray microscopy.

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4 CATCHBIO-projects CHEMIE.PGT.2016.012
Utrecht University / CatchBio

Multitechnique characterization of lignin and lignin-derived products-1;Multitechnique characterization of lignin and lignin-derived products; Levulinic acid hydrogenation: On the influence of catalyst synthesis, feed impurities, and process parameters on catalyst stability.; Continuous process of the hydrothermal conversion of lignin.
