



Federal Ministry
of Education
and Research



Material Innovations Made in Europe

German Success Stories Supported by European Research Funding



Contents

Information on European Research Funding	2
Nanosensors for Controlling Air Quality	6
A New Breed of Rotor Blade	8
“Liquid Building Envelopes” that Mimic a Waterfall	10
Custom-made Nanoparticles	12
Inks with Exquisite Properties	14
The Right Material at the Right Place	16
Improving Organic Plastics	18
The Next Generation in Urban Mining	20
Ecologically Optimized Batteries	22
An Innovative Treatment for Multiple Sclerosis	24
How to Apply for Funding	26
Imprint	29

Information on European Research Funding

Horizon 2020 is the European Union's framework program for research and innovation. The program aims to augment the competitiveness of the European economy while also fostering a society based on knowledge and innovation. An additional goal is to promote sustainable development. To ensure a targeted impact on European society, the program is invested with a number of priorities and also includes a comprehensive toolbox of measures.

Structure of Horizon 2020 program

The current EU framework program for research and innovation – Horizon 2020 – is designed to promote economic competitiveness while also creating a base of knowledge across Europe. The program is divided into several parts.

Horizon 2020 rests on three pillars, making it far more than a research framework program (RFP). By bringing the previously separated EU research and innovation funding programs together under one umbrella for the first time, the program is excellently positioned to ensure that internationally competitive research is effectively translated into growth and jobs. The European Research Area is a political concept of the European Union. Its purpose is to create a uniform framework for research and innovation in Europe. To this end, a key focus is placed on researcher mobility as well as the free exchange of scientific and technical knowledge.

- **Pillar: Excellent Science**

This pillar ensures leading European scientists are sustainably supported and promoted. The European Research Council (ERC) awards grants to first-rate institutes and scientists to pursue promising projects. Future and Emerging Technologies (FET) advances innovative basic research in order to lay the foundations for new technologies and areas of research. Marie Skłodowska Curie Actions advance careers in science by supporting transnational research visits. The goal is to encourage young scientists to gain experience in other countries. Building research infrastructures promotes networking among European researchers and gives Europe a unique international advantage in innovation.

- **Pillar: Industrial Leadership**

Research and development is a core activity at universities and colleges, but it also plays a central role in industry. Leadership in Enabling and Industrial Technologies (LEIT) specifically targets key technologies

to promote new products and greater competitiveness. The development of new materials or production technologies is crucial for the private sector, but it also offers solutions to societal challenges. Because considerable investments are always required to implement good ideas, access to venture finance should also be ensured. Establishing a specific SME instrument for this purpose will more effectively integrate innovative small and medium-sized companies into the economy.

- **Pillar: Societal Challenges**

A large portion of the funding is directed to projects working on solutions to societal problems. For example, demographic shifts have resulted in changing requirements and new challenges in medical care and nursing. New concepts for modern health care and long-term care must be developed going forward. Investments must be made in sustainable agriculture, the fishing industry, the bio-economy and maritime research to ensure food supplies keep up with population growth.

Climate change and its consequences must be minimized. Alternative, sustainable fuels for mobility and cost-effective CO₂-neutral energy supplies must be developed to meet greenhouse gas emission targets (a reduction of 95 percent by 2050). Low-consumption, environmentally-friendly transport must be promoted. Concepts to reduce traffic volume are also required.

A shared understanding of societal challenges is indispensable for successfully managing migration, integration and social injustice. A wide range of research areas are required to develop various approaches to effectively confronting crime, terrorism and natural disasters.

Horizon 2020 Program Structure

I. Excellent Science	II. Industrial Leadership	III. Societal Challenges	Expanded Involvement
European Research Council (ERC)	Leadership in Enabling and Industrial Technologies (LEIT) Information and Communication Technologies (ICT); Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing (NMBP); Space	Health, Demographic Change and Well-Being	Science With and For Society
Future and Emerging Technologies (FET)		Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy	
Marie Skłodowska Curie Actions	Access to Risk Finance	Secure, Clean and Efficient Energy	Joint Research Centre (JRC)
Research Infrastructures	Innovation in SMEs	Smart, Green and Integrated Transport	
		Climate Action, Environment, Resource Efficiency and Raw Materials	European Institute of Innovation and Technology (EIT)
		Inclusive, Innovative and Reflective Societies	
		Secure Societies	

Some descriptions have been partially amended;
see: horizont2020.de/einstieg-programmstruktur.htm

Other activities

In addition to these three pillars, the program has further goals. Regions with weak economies and limited research capabilities will be developed to ensure the broadest possible foundation for innovative, cutting-edge research. Science should also take into account social concerns. The Joint Research Centre (JRC) is the EU Commission's scientific service, and advises the EU on scientific issues related to policy making. The European Institute of Innovation and Technology (EIT) promotes and strengthens synergies between business, education and researchers.

The future of the Horizon program

After the EU framework program Horizon 2020 (2014–2020) ends, the next program, Horizon Europe, will commence and cover the period from 2021 to 2027.

Many of the successful elements of the Horizon 2020 program will be retained, and the new program will also rest on three pillars:

- Excellent Science
- Global Challenges and European Industrial Competitiveness
- Innovative Europe

An overview of the current discussion about the program can be found at <http://ec.europa.eu/horizon-europe>.

German success stories

In the first four years of Horizon 2020, 17.5 percent of the approximately two billion euros in funding approved for the nanotechnologies, advanced materials, biotechnology and advanced manufacturing and processing (NMBP) program area went to German partners. This shows that German applicants were particularly successful in this area compared to other parts of the program. Another key figure underlines even more impressively the importance of European projects for German research:

Germany participated in 84 percent of all NMBP projects.

The motivation for participating in EU projects varies. Most applicants are attracted by how well the European programs complement national funding. Most research projects require an international context, and cannot be adequately handled by domestic partners alone. International networking opportunities in the specific research area, new market development possibilities and access to European research or industrial infrastructures (e. g. pilot lines, open innovation test beds) are also highly appealing to German partners. In Horizon 2020, more than half of all German applicants come from industry. This underlines the attractiveness of EU research program for both large corporations as well as small and medium-sized enterprises (SMEs).

This brochure outlines the achievements of ten German partners to illustrate the added value of EU research funding. The projects presented exemplify the wide range and broad diversity of topics pursued in materials research. But they are also case studies in how cross-border cooperation benefits all participants alike. The goal is to attract potential applicants in research and industry to actively participate in the next Horizon Europe framework program.

The projects presented here were funded by the European Union's research and innovation program Horizon 2020 in conformance with the following grant agreements:

SENSindoor:	604311
WALiD:	309985
LaWin:	637108
CO-PILOT:	645993
DIMAP:	685937
FlexHyJoin:	677625
BIO4SELF	685614
ADIR:	680449
SINTBAT:	685716
N2B-patch:	721098

German Success Stories
Supported by European Research Funding

Nanosensors for Controlling Air Quality

Nine research partners from several countries worked on developing advanced sensor systems to monitor indoor air quality and ensure clean air by providing ventilation as required. In the international project SENSIndoor, industrial-scale production methods were developed to reduce the costs of manufacturing these sensors.

As people typically spend 80 to 90 percent of their day inside, indoor air quality has a major impact on human health. Advanced sensor systems that perform continuous monitoring are an indispensable tool for ensuring the quality of indoor air. Such monitoring is particularly important when there is a risk of volatile organic compounds that could be harmful to human health. When the concentration of these harmful compounds is too high, providing ventilation as needed optimally balances energy efficiency with requirements for healthy indoor air.

In the SENSIndoor project, researchers in France, Finland, Sweden, Switzerland and Germany studied sensors that exactly meet these requirements. The researchers developed sensors using precise nanostructuring that are extremely sensitive and selective when detecting harmful compounds. The consortium also developed industrial-scale production methods to reduce the costs of manufacturing the sensors.

Developing new technology

The project specifically focused on three harmful gases that pose a particularly high health risk: benzene, formaldehyde and naphthalene. These compounds, which are often found in paints, flooring and furniture, are carcinogenic and highly toxic even in small concentrations.

The project's innovative approach was to develop new micro-preconcentrators using porous metal-organic frameworks (MOF) and polymer layers that bind certain molecules very selectively. These pre-concentrators are the first ever developed that transport gas solely by diffusion, eliminating the need for expensive and fragile micropumps.

Concentrating the target gases also increased the devices' sensitivity by almost two orders of magnitude. Reducing interference from permanent gases such as CO, H₂ and water increased the selectivity to more than four orders of magnitude to unprecedented levels (for example, one ppb of benzene in a background of ten ppm ethanol). The sensor systems were tested in extensive laboratory and field trials. The results were then verified in comparative studies conducted by metrological research facilities in Germany and Italy.

"The SENSIndoor project's multiplier effect for the partners involved has been considerable, and its full benefit has yet to be seen. This EU project effectively facilitated networking among the participating work groups from research and manufacturing, significantly boosting their international profile. That allowed the partners to address new application areas," said Prof. Dr. Andreas Schütze of Saarland University, who coordinated the project.

SENSIndoor

PROJECT DURATION: 01.01.2014–31.12.2016

PROJECT VOLUME: 4 619 315 euros

EU FUNDING: 3 399 995 euros

PROJECT WEBSITE:

sensindoor.eu

CONTACT PERSON:

Prof. Dr. Andreas Schütze, Saarland University

CONSORTIUM:

- Coordinator: Saarland University, Germany
- NanoSense SARL, France
- Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V., Germany
- Oulun yliopisto, Finland
- Universitet Linköping, Sweden
- SenSiC AB, Sweden
- SGX Sensortech S.A., Switzerland
- 3S – Sensors, Signal Processing, Systems GmbH, Germany
- Picodeon Ltd Oy, Finland
- Eurice GmbH, Germany

What are concrete success stories of the project – taking sensor systems to market

DANSiC is a spin-off project of the University of Linköping that applies recent research to develop and market gas sensor systems for assessing indoor air quality. Partly developed as part of SENSIndoor, the software package DAV³E (Data Analysis and Verification/Visualization/Validation Environment) is an open source project. This tool is designed for the rapid development and reliable assessment of evaluation algorithms in R&D projects. Because it is freely available, this tool can also be used by other groups.

In June 2017, the SENSIndoor project was awarded the Best Project Award at the EuroNanoForum 2017 in Malta. The award recognizes current and completed EU projects in the field of nano and materials sciences with outstanding potential benefits for industry and society. The binational dissertation of Dr. Christian Bur, University of the Saarland and University of Linköping, won the AHMT (Arbeitskreis der Hochschullehrer für Messtechnik) Measurement Technology Prize in 2015 for best German-language dissertation in the field of measurement technology.

What accompanying and follow-up activities have resulted from the successful project?

Using the project results, the manufacturing partners are currently developing a range of marketable products including sensor elements and sensor systems. The project partners are cooperating with a variety of other partners to develop the products. Several researchers employed by academic project partners were hired by the industrial project partners to continue their work developing marketable technologies begun within the project. The products range from technologies for assessing indoor air quality to sensors for outdoor air quality and odor evaluation. The goal is to address further application areas such as respiratory gas analysis or odor monitoring. The project will also offer new approaches to environmental monitoring to complement the work of existing official measuring stations, whose



Batch of sensor pre-concentrator systems partially covered by a precisely positioned gas inlet

number is limited. These approaches could be useful for smart cities that offer new environmental information services or citizen science projects. During the project period, a number of new relationships and cooperation projects were established. The BMBF project SEPEG was formed to study measurement technology for volatile organic compounds used in odor measurement.

Bring the excitement of scientific research to schools

In addition, a comprehensive education and training concept was developed with a focus on industrial users as well as aspiring scientists. One component is a project that introduces schoolchildren to gas measurement technology and encourages them to carry out their own environmental studies, such as recording indoor air quality in schools (DBU project SUSmobil; susmobil.de). The goal is to attract future researchers to this exciting topic early in their schooling while strengthening their environmental awareness at the same time.

A New Breed of Rotor Blade

An international research consortium including 15 partners is working on rotor blades with a cost-effective, advanced and lightweight composite material design (Wind Blade Using Cost-effective Advanced Composite Lightweight Design, or WALiD for short). The project has garnered considerable attention in the industry. The overarching goal is to develop a competitive rotor blade design for the European offshore wind industry, and thus make key contribution to achieving the EU's climate targets.

Offshore wind turbines are continually increasing in size. Transporting, assembling, disassembling and scrapping these gigantic rotor blades today presents operators with greater challenges than ever. Wind turbines with rotor blades up to 80 meters long and rotor diameters of more than 160 meters are designed to maximize energy yields. Since the length of the blades is limited by their weight, lightweight systems with high material strength are required. The lower weight makes assembly and disassembly of the wind turbines less challenging, and improves stability at sea.

WALiD

PROJECT DURATION: 01.02.2013–31.01.2017

PROJECT VOLUME: 5 499 110 euros

EU FUNDING: 3 964 797 euros

PROJECT WEBSITE:

eu-walid.com/the-project

CONTACT PERSONS:

Björn Beck and Carolyn Fisher,
Fraunhofer Institute for Chemical Technology (ICT)

CONSORTIUM:

- Coordinator: Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V., Germany
- WPS Windrad Power Systems GmbH, Germany
- Norner Innovation AS, Norway
- Smithers Rapra and Smithers Pira Limited, UK
- Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek TNO, Netherlands
- A.P.T. Archimedes Polymer Technologies LTD, Cyprus
- PPG Industries Fiber Glass BV, Netherlands
- Norner AS, Norway
- Comfil ApS, Denmark
- Loiretech SAS, France
- Coriolis Composites SAS, France
- Stichting Nederlands Normalisatie-Instituut, Netherlands
- Windrad Engineering GmbH, Germany
- Norner Research AS, Norway
- Loiretech Mauves, France

Developing new thermoplastic tape materials for an automated tape laying process

The researchers focused on the shape of the rotor blades as well as the materials. The rotor blade design was also adapted for thermoplastic tape materials and the blades connected using an innovative approach. As part of the project, thermoplastic tape materials were developed for an automated tape laying process that was used on various structural and semi-structural rotor blade components. The researchers also carefully studied the properties of thermoplastic foams used as core materials in the sandwich components in the shear web area. In addition, they succeeded in improving the environmental durability of the thermoplastic coatings.

Currently, wind turbine rotor blades are manufactured using thermoset resin systems requiring a greater number of manual work steps. Since they harden permanently after a single heating, a serious drawback of these blades is that they cannot be recycled. WALiD relies on thermoplastic materials instead. These re-meltable polymer materials can be efficiently processed in automated production lines with fewer manual steps than conventional thermoset polymers. Thermoplastic materials can be used on the outer shell of the rotor blades as well as in segments of the interior supporting structure.

Extremely rigid carbon fiber-reinforced thermoplastics are required in areas where stress is greatest on the blade. Glass fiber is used to reinforce areas under less stress. The design innovated the use of thermoplastic materials in the shear web area, permitting individual segments to be manufactured separately and then joined afterwards. Use of the new ultra-light and rigid thermoplastic tape materials with enhanced mechanical properties facilitated fast and cost-effective manufacture of the rotor blades by maximizing automation.

Working together for the future

The thermoplastic WALiD coating is a protective surface layer that ensures longer durability under harsh conditions. A new prediction model was also applied to assist in the development of the coatings. The model provided detailed insights into the relationship between surface properties and erosion resistance.

“WALiD gave us the opportunity to draw on expertise from across Europe and attain results beyond what could be achieved at a national level. It was a privilege to work with these partners on such an important issue for future research. Our joint work has also resulted in bilateral collaborations whose benefits to the participating companies extended beyond the end of the project,” commented Björn Beck of the Fraunhofer Institute for Chemical Technology (ICT), which was responsible for coordinating the project.

By collaborating with the scientific community, the industrial partners achieved results that benefitted their business and increased their competitiveness. The project clearly made an important contribution to Europe’s innovative strength. International co-operation also promotes interaction among different segments of the supply chain. That in turn results in improved quality levels.

Researching how to meet EU climate targets

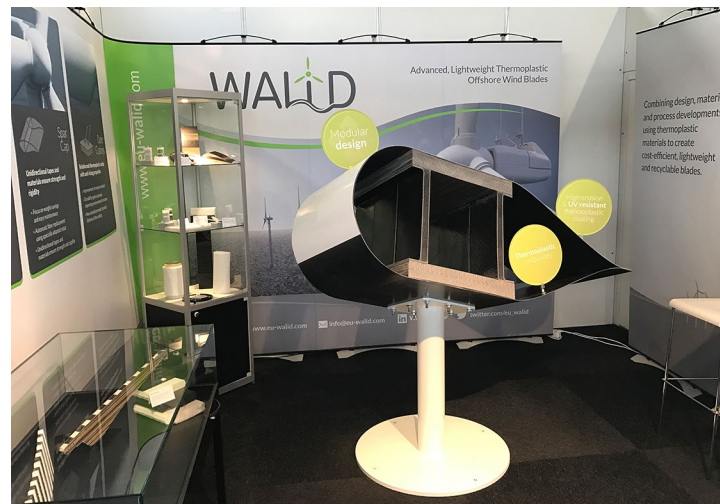
In 2009, the EU set itself the legally binding target of supplying at least one fifth of its energy requirements from wind and other renewable resources by 2030. By 2020, wind energy is required to supply 12 to 14 percent of total EU electricity demand.

Both onshore and offshore wind power will make an important contribution to energy supplies. In addition to the target set for all renewable energy for 2020, the following targets have been set for the wind industry:

- 180 GW total installed capacity (including 35 GW offshore)
- Annual installations of 16.8 GW (including 6.8 GW offshore)

That target was then raised by the EU in 2014 to 27 percent in renewable resources by 2030, which is equivalent to 46 to 49 percent of electricity generation. Forecasts predict that wind energy will generate most of this electricity, contributing at least 21 percent.

Although the European offshore wind industry has grown enormously over the past decade, it still faces challenges. The biggest is achieving cost competitiveness. That includes reducing financial costs associated with the supply chain such as those for construction and assembly facilities. Analyses have shown that the European offshore wind industry must reduce costs by 26 percent to be competitive with conventional energy sources by 2023. The WALiD project aims to help industry achieve this goal.



Project presentation at exhibition stand

“Liquid Building Envelopes” that Mimic a Waterfall

Funded by the European Commission, the LaWin project (“Large Area Fluidic Windows”) included a program to develop “liquid building envelopes.” A liquid building envelope imitates the thermal properties of a waterfall. Liquids that are transparent in visible light circulate in exterior walls and windows to transform passive wall surfaces into thermally active building components. A fluid flows through a large transparent window, turning the pane into a heat exchanger.

The project developed a glass pane with an internal capillary system. Within the system, a transparent liquid flows through the capillaries. The capillaries are fed through pressure channels connected to the window device. The liquid acts as a carrier of heat, enabling regulation of the indoor temperature, and harvesting of exterior solar or thermal energy.

The concept is ideally suited for low-temperature systems, meaning heating systems that operate at comparatively low temperatures. In conventional interior heating systems, flow temperatures of 60

degrees Celsius are standard. But in low-temperature systems, flow temperatures rarely exceed 30 degrees Celsius, even on cold winter days. Radiant floor heating is one example of a low-temperature system.

Reducing dependency on environmentally harmful fossil raw materials

Buildings account for more than a third of the world’s energy demand and associated CO₂ emissions. We now spend more than three-quarters of our lives inside buildings. We also demand that buildings conform to ever higher standards of comfort and functionality. “The development of new, sustainable, CO₂-efficient materials and processes to reduce building energy requirements while at the same time increasing building functionality and comfort is a key goal in international technology roadmaps,” says Prof. Lothar Wondraczek of Friedrich Schiller University Jena, who coordinated the 14 consortium partners. “As part of the Horizon 2020 program, our consortium was able to carry out the research and development work that focused on realistic implementation from the start. Broad networking activities across the various project clusters facilitated direct synergies, and the development of approaches for additional spin-off technologies.”

The “liquid building envelope” significantly boosts insulation efficiency and dramatically lowers heating or cooling costs by adapting to the weather forecast and season. The circulating liquid is used as a heat carrier medium that moves heat from the environment into the building, distributes it within the building or removes it from the building.

LaWin

PROJECT DURATION: 01.01.2015–31.12.2017

PROJECT VOLUME: 7 508 780 euros

EU FUNDING: 5 481 912 euros

PROJECT WEBSITE:

lawin.uni-jena.de

CONTACT PERSON:

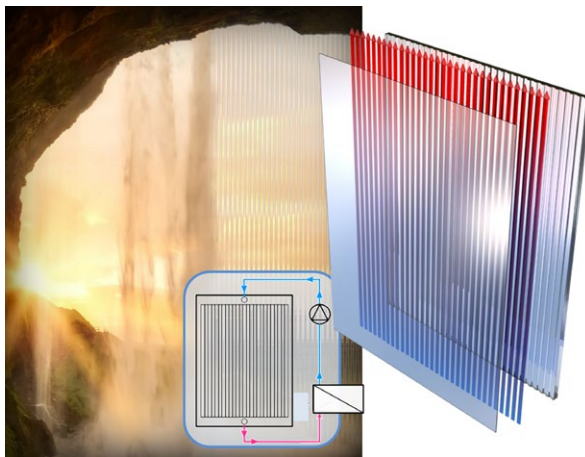
Prof. Dr. Lothar Wondraczek,
Friedrich Schiller University Jena

CONSORTIUM:

- Coordinator: Friedrich Schiller University Jena, Germany
- Schott Technical Glass Solutions GmbH, Germany
- Bauhaus University Weimar, Germany
- Ducatt NV, Belgium
- EurA Innovation GmbH, Germany
- Glass Service, a.s., Czech Republic
- Flachglas Sachsen GmbH, Germany
- Eilenburger Fenstertechnik GmbH & Co. KG, Germany
- A. + E. Ungricht GmbH + Co. KG, Germany
- Fickert + Winterling Maschinenbau GmbH, Germany
- Beuth Hochschule für Technik Berlin, Germany
- Folienwerk Wolfen GmbH, Germany
- Clariant Produkte (Deutschland) GmbH, Germany
- LISEC Austria GmbH, Austria

Taking an integrated approach to new technology

Developed for large-scale, functional glass elements with integrated channel structures, the technology has made liquid building envelopes a reality. Taking an integrated approach, the technology was also applied to produce completely fluidic double and triple-glazed windows. Besides functioning as heat exchangers, these window systems can be used for active shading, solar thermal energy generation or programmed façade color designs. Used as flat cooling elements, they can sustainably replace conventional air conditioning systems with high energy requirements that rely on strong air movement.



Concept diagram

The fundamental challenge was to cost-effectively and sustainably integrate a liquid heat transfer medium into high-quality building envelopes without limiting the surface area or harming the environment. Window systems are energetically the weakest parts of modern building envelopes. But they pose a particular challenge, because they must remain transparent and visually well-integrated into the building design. If liquids are integrated into “smart windows,” they can also certainly be integrated into the other non-transparent façade elements.

This funding phase focused on innovating large-area fluidic elements that would enable functional fluids to be integrated into window and façade elements of

active and passive building envelopes. These elements rely on a glass-glass laminate in which one glass element contains capillary structures. The capillary structures transport a heat exchanger fluid. The laminate elements had to meet several requirements for the widespread use. Besides serving its primary function over the long term, the elements had to be successfully integrated into existing production processes for double or triple glazing as well as fulfill life cycle analysis requirements. The project also developed integration concepts for implementing the technology in the building infrastructure. These included a concept to interconnect the various elements, fluidics concepts, heat transfer concepts (heat pumps) and an approach to promoting user acceptance.

The project’s success led to a number of ideas for further applications. Indoor air conditioning could be developed by applying this energetically sustainable cooling technology on a large scale and integrating it attractively into the building’s architectural design. Fluidic windows could also be used as air heat exchangers for providing heating (or cooling) directly through the window surface. In addition they could carry functional liquids (such as photochromic, electrochromic or thermochromic liquids) for shading the interior, or for targeted control of the spectrum of light that penetrates the building. “The unique selling point of this new technology is less its individual functions than its potential to combine several functions,” says Lothar Wondraczek.

Custom-made Nanoparticles

Many viable ideas for new industrial products remain untested because the technical infrastructure required is lacking. That is particularly true for nanoparticles. The research project CO-PILOT has now succeeded in flexible pilot-production of relatively inexpensive nanocomposites. The 13 consortium partners established an “open access infrastructure” to enable primarily small and medium-sized enterprises (SMEs) to experiment with nanotechnology.

At the Fraunhofer Institute for Silicate Research ISC in Würzburg, researchers use the term “nanokitchen” to describe their laboratory work to non-scientists. The lab’s highly specialized equipment includes a 100-liter stirred-tank reactor for upscaling laboratory syntheses and a six-foot semi-continuous centrifuge. The ISC has become the go-to partner for companies and scientific institutions looking to test their nanoidea on a small scale. Since SMEs may not have the technical infrastructure required to produce, modify or process nanoparticles, the ISC is an important resource for these companies in particular.

Nanoparticles pave the way to new product benefits

In recent years, functional composite materials using nanomaterials and nanoparticles have become increasingly important. Nanoadditives can be used to achieve a range of desirable material properties that in turn open the door to entirely new product benefits. But up until now, the limited availability of nanoparticles suitable for production has held product developers back. These quantities are typically less than a gram. The infrastructure required to produce larger quantities is expensive. In addition, the synthesis processes are prone to failure and not conveniently scalable. As a result, many viable ideas are shelved before actual product development begins.

“That’s why the EU has promoted a new approach to these services,” says Dr. Karl Mandel, head of particle technology at the Fraunhofer ISC. “For testing purposes, easy and open access to high-quality infrastructure for reliably producing small batches of functionalized nanoparticles and nanocomposites could help chemical and pharmaceutical companies make the shift to new nanobased products.” He compares the pilot line to a high-tech kitchen. “We provide sophisticated equipment and professional chefs to produce an a la carte nanomenu or cook up special orders. So companies can test out their own recipes or our recipes before they decide to cook them again or set up their own nanokitchen.” In addition to the ISC, two other “open access lines” are available in Eindhoven in the Netherlands and at the Southern German Plastics Center (SKZ) in Selb, Germany.

CO-PILOT

PROJECT DURATION: 01.01.2015–31.01.2017
PROJECT VOLUME: 5 475 358 euros
EU FUNDING: 5 021 858 euros

PROJECT WEBSITE:
h2020copilot.eu

CONTACT PERSON:
 Dr. Karl Mandel, Fraunhofer Institute
 for Silicate Research (ISC)

CONSORTIUM:

- Coordinator: Netherlands Organization for Applied Scientific Research (TNO), Netherlands
- Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V., Germany
- SKZ-KFE gGmbH, Germany
- Momentive Performance Materials GmbH, Germany
- LS Instruments AG, Switzerland
- Sonaxis S.A., France
- Institute of Occupational Medicine, UK
- Trinity College Dublin, Ireland
- Carl Padberg Zentrifugenbau GmbH, Germany
- Nabaltec AG, Germany
- Ioniqa Technologies BV, Netherlands
- Kriya Materials BV, Netherlands
- Stichting NanoHouse, Netherlands

The project yields extraordinary equipment

The Würzburg facility's project team has years of experience in designing particle materials and properties and controlling complex syntheses. That attracts attention of many customers. The EU-funded project has helped establish extraordinary equipment for robust and reliable manufacturing processes. The project-team developed an innovative prototype of a semi-continuous centrifuge for particle separation especially for this pilot line. Up to five kilograms of particle gel with a 70 percent solids content can be "harvested" from the synthesis batch in each cycle. Online analytical instruments allow continuous monitoring and control of particle synthesis and functionalization. Synthesis processes as well as particle separation can be controlled precisely and efficiently, guaranteeing a reproducible particle property profile even at the kilogram scale.

The pilot line was tested with four different particle systems:

- Layered Double Hydroxides (LDH) used as flame retardant fillers for compounding in plastics
- Titanium dioxide for highly refractive composites used in optics
- Hollow silica particles for filled silicone polymers
- Magnetic particles with catalytically modified surfaces for PET recycling

Material design and synthesis routes also permit the functionalization of particles for further processing, e. g. by adapting the matrix's chemical composition during compounding.

Nanoparticles can be used to reduce the flammability of plastic, for example. They can also give surfaces new properties, as in the case of photovoltaics. Modifying photovoltaic system surfaces can prevent dust deposits on the glass surfaces. Nanotechnology can make plastics more tear-resistant and durable, permitting a range of new applications. The "nanokitchen" can also help develop more sophisticated fuel cells or catalysts. The results of the CO-PILOT project will be used as a starting point for follow-up projects. As part of the current year's EU research project OASIS, the



The Ruhr reactor for particle synthesis with a 100-liter capacity

Fraunhofer ISC is working on a pilot program to develop inductively heated magnetic particles for innovative pultrusion processes.

Inks with Exquisite Properties

3D printing has revolutionized health care with products ranging from a human lower jaw made of titanium to an artificial aorta valve. But 3D printing technology has enormous potential in many other areas as well. The DIMAP research project studied using this production technology to develop and optimize materials such as silver or ceramic nanoparticles with excellent conductivity, high-performance polymers and foamable inks for lightweight construction applications.

The stated aim of DIMAP (novel nanoparticle enhanced digital materials for 3D printing and their application shown for the robotic and electronic industry) was to expand the areas of application and potential of multi-material 3D printing.

The project succeeded in defining 3D printing materials with completely new property profiles for PolyJet technology and developing them using nanotechnology. These materials included:

- electrically conducting inks using silver nanoparticles
- thermally conductive inks using ceramic nanoparticles
- foamable inks for lightweight construction applications
- high-performance polyimide inks

A specific printer architecture was developed to print these materials.

Creating new possibilities in 3D printing

In addition to plastic parts, modern 3D printers can also process stainless steel, aluminum or titanium. This kind of additive manufacturing (as opposed to subtractive manufacturing that removes material by milling or sawing) requires materials specifically adapted to the technology used. PolyJet technology has a multi-material printing capability unique among 3D printing technologies, as it permits unrivaled functional integration within the printing process. However, the technology has suffered from two weaknesses: a limited material range, and poor material durability.

The twelve consortium partners focused their efforts on addressing these two deficiencies. The international team of scientists from Israel, the Netherlands, Austria, Spain and Germany sought to harness new materials, and, by extension, widen the range of possible applications for this technology. The project team integrated silver and ceramic nanoparticles into the printing process. They also developed design strategies to achieve better product properties, a particularly demanding and complex task.

The first step was to analyze the material requirements. The partners developed formulas for this purpose. The result was then optimized by adding compatible nanoparticles. Computer-based simulation models were used to help develop the new materials. The outcome was four new inks that open up new possibilities for 3D printing (for example, in the field of electrical engineering):

- Electrically conductive inks with silver nanoparticles for printing conductor tracks and electrical components
- Thermally conductive inks with ceramic nanoparticles for applications such as cooling LEDs

DIMAP

PROJECT DURATION: 01.10.2015–30.09.2018

PROJECT VOLUME: 4 997 351 euros

EU FUNDING: 4 997 351 euros

PROJECT WEBSITE:

dimap-project.eu

CONTACT PERSON:

Thomas Lück, cirp GmbH

CONSORTIUM:

- Coordinator: Profactor GmbH, Austria
- Stratasys Ltd., Israel
- Karlsruher Institute for Technology, Germany
- Borealis Polyolefine GmbH, Austria
- Tiger Coatings, Austria
- Festo AG & Co. KG, Germany
- Linz University, Austria
- Soreq Nuclear Research Center, Israel
- cirp GmbH, Germany
- P.V. Nano Cell Ltd., Israel
- Tecnología Navarra de Nanoproductos S.L., Spain
- Signify Netherlands BV, Netherlands

- Foamable inks for lightweight construction applications and low material consumption
- High-performance polyimide inks for very high temperature resistance and excellent chemical resistance

Among the research consortium's signature achievements was the first polyimide-based material print using a PolyJet machine. "The DIMAP polyimides are distinguished by their very high temperature resistance and superb dielectric properties," explained Thomas Lück, who heads up sales and innovation at the DIMAP consortium partner cirp GmbH based in Heimsheim.

In the printing process, the project also succeeded in applying conductive sintering to silver-based inks. Sintering refers to heating a material to change its structure, facilitating the integration of prefabricated components.

The electrically conductive and high-performance polyimide inks were developed by the project into mature technologies. The ceramic and foamable inks are still at the experimental development stage. As a result, they were not installed in the demonstrators. The DIMAP materials were processed on a prototype DIMAP polyjet printer used by three different project partners. That meant the various work packages could be processed in parallel and then brought together for

joint consideration afterwards. Many elements of the hardware and software used to process the DIMAP materials were upgraded.

"The project significantly increased cirp GmbH's expertise, and grew the company with a number of new hires," says Thomas Lück. "We have to stay on the cutting edge of technology so that our range of services will always offer unique advantages for our customers. Participating in research projects consistently results in collaborations that sustainably improve development."

cirp GmbH is confident that the new market-ready DIMAP materials will soon help expand the range of services offered by this medium-sized firm. Many of the DIMAP project's successes achieved through multidisciplinary international collaboration have already resulted in range of potential follow-up projects. There are also plans for a DIMAP follow-up project. The consortium partners will conduct further experiments with the DIMAP test printers separately in-house.



Maximum functional integration permitted the pneumatic Festo robot actuator to be printed in one step.

The Right Material at the Right Place

Ten international European research partners participating in the FlexHyJoin project have developed a fully automated production cell to manufacture weight-neutral hybrid structures made of metals and polymer composites without the use of adhesives. Hybrid joining also reduce costs and production time in large scale production, thus benefitting industry.

The primary goal of FlexHyJoin (Flexible Production Cell for Hybrid Joining) was to develop a prototype production cell for joining hybrid components made of thermoplastic fiber-reinforced polymer composites (TP-FRPC) and metals.

The project applied a range of techniques in combination, including laser pretreatment of the metal surfaces, induction and laser joining, process control and monitoring and non-destructive testing using lock-in thermography. The aim was to develop a joining process specially adapted to hybrid metal and TP-FKV compounds so that the materials could be exploited to their full potential. Unlike adhesive bonding, these processes do not require additional additives. The load-bearing fiber structure of the TP is not damaged as with screwing or clinching. The project developed a

fully production of a roof made of continuously glass-fiber reinforced polyamide six with metallic connecting elements, demonstrating the technology's readiness for large-scale production.

Combining innovative technologies efficiently

In the first step, the metal elements formed in a stamping process are pre-structured by a high-speed laser in the production cell. Linear cavities with indentations are created to ensure a connection between the metal and the TP in the subsequent joining step. After surface structuring, the connecting elements and the roof are brought to the joining step. The metal supports are positioned on the preformed, thermoplastic organic sheet metal profile of the roof. The side parts are then heated by laser and by electromagnetic induction. By heating the metal, the matrix material of the TP becomes molten with the metal. Then, by simultaneously applying joining pressure, flows into the laser-induced cavities on the metal surface.

To ensure that the bond meets quality requirements, the joints are non-destructively tested for defects using lock-in also within in the production cell. After quality control, the hybrid components can be integrated into higher-level assemblies. By combining all of these technologies efficiently, the FlexHyJoin project succeeded in designing a production cell that could provide tailor-made joining technologies for hybrid components. "Coordinating such a productive EU research project together with highly motivated partners from across Europe was an extraordinary and inspiring experience. In designing and successfully building the FlexHyJoin production cell, the project achieved an extremely ambitious goal," said project coordinator Nora Feiden from IVW, speaking on behalf of the entire team. Lighter components reduce carbon dioxide emissions in the automotive industry, positively impacting the environment. The FlexHyJoin project's hybrid joining technology is paving the way for future mobility concepts.

FlexHyJoin

PROJECT DURATION: 01.10.2015–31.12.2018

PROJECT VOLUME: 5 868 683 euros

EU FUNDING: 4 141 347 euros

PROJECT WEBSITE:

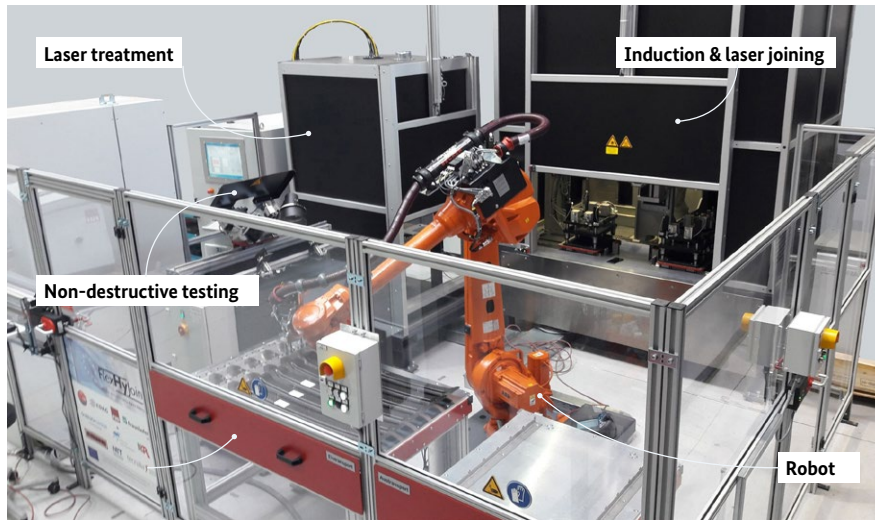
flexhyjoin.eu

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Cell developed by the project FlexHyJoin

Paving the way for new designs

The development of the cell lays the groundwork for new designs in hybrid lightweight construction. The technology can facilitate innovation in areas such as e-mobility or load-specific vehicle structure reinforcement using fiber-reinforced plastic composites. The joint quality and strength combined with the short production cycle time make the technology useful for a wide range of applications. In addition to the automotive industry, other application areas include medical equipment, sports and leisure products, and the aerospace industry.

The project succeeded in combining several large-scale production processes. Going forward, these processes can be adopted by end users or developed further by research institutions.

There are a range of possibilities for further developing the technology:

- Extending component geometries
- Drawing up design guidelines that take into account this joining technology's unique features
- New tool concepts
- New material combinations
- Innovative concepts for process control and monitoring (Digital Twin, Industry 4.0)

One of the consortium partners designs engineering services for the automotive industry. This partner believes the FlexHyJoin technology has enormous potential for developing innovative lightweight

solutions in exterior and interior applications, in particular for newly designed vehicles and components in areas such as electromobility. The raw material and semi-finished products industry also sees potential in the technology. There are plans to test the technology with other material combinations that are tailored to special applications required for upcoming client projects.

Improving Organic Plastics

Bioplastics are taking markets by storm. Polylactic acid has rapidly become a key material for household items, clothing or the packaging industry. Polylactides (PLA) – commonly called polylactic acid – are artificially produced chemical substances with varying properties that depend on their composition. The Bio4Self project developed and tested self-reinforced fiber composite plastics (eFVK) made of PLA.

Fifteen research partners from Belgium, Denmark, Germany, the Netherlands, Italy, Spain, Turkey, Slovakia, Greece and the United Kingdom participated in the Bio4Self research project. The goal of their collaboration was to increase the mechanical properties (stiffness, tensile strength, impact strength) of PLA. PLA granules of varying quality are sold to the plastics processing industry to manufacture films, molded parts, packaging

and other common items. But unlike standard plastics that are still mainly produced from crude oil, PLA are produced from renewable raw materials such as corn.

Researchers in the Bio4Self project studied a range of techniques for boosting the performance of these plastics, and, by extension, expanding their areas of application. One approach was to reinforce PLA with what are termed LCPs (Liquid Crystalline Polymers). These special plastics contain liquid crystalline polymers that permit thermoplastic processing in a melt mixing process. Selected antihydrolysis agents were also used to improve the durability of these PLA-based composites. Another goal was to functionalize the PLA with photocatalytic polymers (self-cleaning function), tailor-made microcapsules (self-healing function) and deformation detection fibers (self-aware function).

“We are currently working on demonstrating the potential of these new biobased composites by developing prototypes for the automotive sector or of household appliances,” says Thomas Köhler of the Institute of Textile Technology (ITA) at RWTH Aachen University, one of the German consortium partners. Manufacturing products such as interior car linings, hard-shell cases or washing machines using bioplastics in the near future will require optimizing their existing properties. The mechanical and thermal properties of the material must be modified and improved. Thomas Köhler emphasizes the research’s positive impact on the environment. “I believe that making processes sustainable is also crucial for reducing CO₂ emissions,” he says. “In addition, there’s an urgent need for fully organic alternatives to petroleum-based plastics.”

Bio4Self

PROJECT DURATION: 01.03.2016–30.06.2019

PROJECT VOLUME: 8 051 688 euros

EU FUNDING: 6 772 639 euros

PROJECT WEBSITE:

bio4self.eu

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- Arçelik A.Ş., Turkey
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- Anonymi Etaireia Viomichanikis Erevnas, Technologikis Anaptyxis Kai Ergastiriakon Dokimon, Pistopiisis Kai Piotitas, Greece
- Ion Beam Applications SA, Belgium
- Steinbeis Advanced Risk Technologies GmbH, Germany
- Open Source Management Ltd., UK

Establishing new industrial processes

The German Federal Ministry of Education and Research has identified achieving a sustainable economy through bioeconomy and meeting climate protection goals as key challenges going forward. The Institute of Textile Technology at RWTH Aachen University has for many years emphasized research on sustainable processes and materials, including the melt spinning of biopolymers, the processing of natural fibers for textiles, and fiber-reinforced plastic (FRP). The institute also works closely with industry and SMEs to develop innovative products in a range of sectors. “We fit well in the Bio4Self project. Cross-border cooperation in Europe is always productive. Both research institutes and companies benefit from the exchange,” says Köhler. “Bio4Self enabled the ITA to expand its expertise in areas such as melt spinning of biopolymers, production of hybrid yarns using air texturing and consolidation of thermoplastic FRP.”

The results have made a fundamental contribution to the institute’s continuing success. They will also prove extremely useful for teaching as well as further research and development. The ITA plans to use the project as a platform for further strengthening international collaboration. Together with some other members the consortium, follow-up projects to study the use of the intermediates are in the planning stages. Industry participation was primarily driven by the pressing need to develop sustainable products.

The project was also successful in the area of manufacturing. The research resulted in the establishment of new industrial processes and products. These include underwater granulation of biopolymers at the project partner TECNARO. The company produces tailor-made compounds from renewable materials for a wide range of products such as furniture and musical instruments. Additional developments include the melt spinning of biopolymer fibers at the partners COMFIL and CHEMOSVIT FIBROCHEM, or PLA processing for automotive and home appliance applications (washing machines or dishwashers) using injection molding processes at MAIER and ARCELIK.

The Bio4Self project has already won two awards: the JEC Innovation Award 2019 in the “Sustainability”

category, and last year’s Techtextil Innovation Award 2019, also in the “Sustainability” category.



Self-reinforced fiber composite plastic (eFVK) made of PLA and PLA fibers

The Next Generation in Urban Mining

Nine European research partners are collaborating on the ADIR project to bring urban mining to a new level. “Urban mining” sees the city as a potential source of raw materials that is too vast to ignore. The ADIR project demonstrated that innovative technologies can be successfully implemented to dismantle and separate components, or to recover valuable materials from old electronics.

The ADIR research project’s full name is “Next Generation Urban Mining – Automated Disassembly, Separation and Recovery of Valuable Materials from Electronic Equipment.” The project is a response to the ever shorter life cycles of electronic devices such as mobile phones and printed circuit boards from servers and computers. Due to constant customer demand for new mobile devices, in Europe alone hundreds of millions of these devices were discarded in 2014. In most cases, the contained valuable materials are leaving the EU by second-hand trade and exports. Scientists from Italy, Austria, Poland, France and Germany are collaborating on the development of methods to conserve these resources.

Their goal is to demonstrate how the selective dismantling of old electronics can yield new, highly enriched materials.

Strategic raw materials and their conservation

A good example of this process is tantalum recovery. So far, the recovery rates for this metal are negligible (about one percent) and the EU is 100 percent dependent on imports. However, the recovery rate is being increased by using lasers to detect, desolder, separate and sort tantalum capacitors.

Tantalum is just one among many raw materials that are becoming increasingly important in high-tech industrial product manufacturing. In particular, electronic devices contain precious metals and a large number of strategic raw materials. Electronic board recycling currently focuses on mass flow concepts such as shredding processes and pyrometallurgy (an energy-intensive metal recovery process) for recovering high-value metallic components such as copper, gold and silver. However, a number of critical elements cannot be efficiently recovered using these procedures, and as a result they are lost.

ADIR’s goal was to demonstrate the feasibility of a key technology for the next generation in urban mining. The project developed an automated electronic device dismantling process to separate valuable components and recover recyclable materials. The concept combines

- image processing,
- robotic handling,
- plasma-induced shock waves,
- 3D laser measurement,
- real-time material identification using a laser (to detect valuable chemical elements),
- laser processing (for selective desoldering of valuable parts, or for cutting out parts of an electronic circuit board),
- automatic separation of the disassembled parts into various sorting fractions.

The project developed a machine concept with short cycle times for selectively dismantling mobile phones or printed circuit boards from servers and computers

ADIR

PROJECT DURATION: 01.09.2015–31.12.2019

PROJECT VOLUME: 6 624 736.25 euros

EU FUNDING: 5 262 200 euros

PROJECT WEBSITE:

adir.eu

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- Pro Automation GmbH, Austria
- OSAI Automation Systems S.p.A., Italy
- LSA – Laser Analytical Systems & Automation GmbH, Germany
- H. C. Starck Tantalum and Niobium GmbH, Germany
- Aurubis AG, Germany
- Tre Tau Engineering s.r.l., Italy
- I-CUBE Research, France

to produce sorting fractions of components containing high levels of recyclable materials. Besides tantalum stated above, germanium, cobalt, palladium, gallium and tungsten are other examples of economically crucial materials with a high supply risk in the EU.

The project developed an ADIR demonstrator for recovering these precious resources. It included seven machines for the automated processing of mobile phones and printed circuit boards from servers and computers. In 2019, the demonstrator was evaluated in field trials at a recycling company in Germany.



Every year, around 190 million mobile phones in Europe reach their end of their service lives.

Metal producing companies participating in the project have tested the processing of these sorting fractions containing specific material enrichments. ADIR has had unprecedented success in demonstrating that modern production technology methods can be used for urban mining.

Dismantling a mobile phone in seconds

The project used the automated interaction of several machines to complement conventional mass flow-based processing methods. “This is a new way to efficiently recover valuable materials that otherwise would be wasted,” says Prof. Dr. Reinhard Noll from the Fraunhofer Institute for Laser Technology (ILT) in Aachen. The target cycle time for processing mobile phones in the ADIR demonstrator is 30 seconds per unit. Large computer boards were processed in under 60 seconds per unit.

The project researchers hope that their scientific work will make a significant contribution to building a sustainable recycling economy for the future. “Bringing a concept to life by leveraging a wide range of expertise from across Europe is exciting. The ADIR project demonstrator is the world’s first set of machines for a piece-by-piece processing of industrial mass products such as mobile phones and computer boards at their end-of-life. The interlinked ADIR machines separate, handle, dismantle, measure, analyze and sort the materials, yielding sorting fractions containing high levels of recyclable material,” stated Reinhard Noll.

A digital passport for retired electrical parts

There are plans to further develop the ADIR approach. The concept has been described as “inverse production.” The goal is to develop transformation processes to gain raw materials, semi-finished products, parts or new products from technical products at the end of their service lives. There are also plans to build a comprehensive data space to promote a sustainable recycling economy. Technical products will carry a “digital passport” that collects product-related physical and chemical data. The passport will significantly facilitate component dismantling or separation as well as secondary raw material recovery.

Ecologically Optimized Batteries

The project “Silicon-Based Materials and New Processing Technologies for Improved Lithium-ion Batteries” (SINTBAT) brings together nine consortium partners. The researchers and their partners from industry are working to increase storage technology safety, reliability and environmental-friendliness.

Battery manufacturers around the world see silicon-based batteries as a key technology for the next generation of cells. How can these electrochemical storage systems suitable for use in high-performance batteries be produced at the lowest cost? The German and European economies could benefit from finding an answer. In addition to reducing costs, improving energy density is a key issue. Both are factors in determining battery use (and battery material use). They are also decisive in determining a storage technology's efficiency, safety and reliability. With the goal of strengthening the European economy, the research consortium took into account the entire value chain by accommodating a range of stakeholders, including battery material suppliers, cell manufacturers and end consumers.

A crucial technology for electromobility

In the 1970s, few predicted that lithium-ion batteries would become a key technology in many markets forty

years later. First developed at the Technical University of Munich, the storage system appeared to have few practical applications. Then a few years later came the first computers, digital cameras and mobile phones with rechargeable batteries. Lithium-ion batteries are now crucial in various domains, including electromobility, which the German government aims to promote. The government's “Electromobility Promotion Program” subsidizes the sale of new electric vehicles in order to reduce air pollution. Greater acceptance of electrically powered vehicles among consumers will require batteries that permit longer driving distances with shorter recharging times.

Basic principles meet applied research

Further basic research and applied research is required to develop new materials and innovative electrode structures. Researchers in the area draw on a wide variety of experimental investigation methods. These methods are required for testing batteries in a stationary state, i. e. when they are not in operation, and for testing them under operating conditions, such as during charging. These in-situ and as in-operando analysis methods yield results used for what is commonly called multi-scale modelling. The modelling simulates ageing mechanisms to reliably predict and increase service life expectancy. The research consortium including partners from France, the UK, Austria, Poland, Sweden and Germany applied various analytical methods to reach their findings. For example, by using silicon as the negative electrode material researchers achieved energy densities of up to 660 watt hours/liter, depending on the application's requirements.

Enabling swift dissemination of knowledge

Thanks to SINTBAT, the partners could quickly share the expertise required to utilize innovative materials and understand the ageing mechanisms. The lithium-ion batteries enhanced by silicon-based

SINTBAT

PROJECT DURATION: 01.03.2016–29.02.2020

PROJECR VOLUME: 9 755 886 euros

EU FUNDING: 8 334 786 euros

PROJECT WEBSITE:

sintbat.eu

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- EurA AG, Germany
- Uppsala University, Sweden
- Materials Center Leoben Forschung GmbH, Austria
- VARTA Storage GmbH, Germany
- University of Warsaw, Poland



Coating machine developed by the project SINTBAT

materials developed are high-powered, long-lasting and cost-effective. Modelling and simulation processes indicate a long service life of more than 20 to 25 years (more than 10,000 cycles) with higher energy density (660 watt hours/liter) and lower costs.

Dr. Martin Krebs, who works for the project coordinator VARTA, expressed confidence that the technology will soon make a successful transition to industrial scale production. “There are viable methods and strategies for increasing performance, reducing costs and extending the service life of the batteries. These include prelithiation, cathode production using special extrusion processes, using polymers or tailor-made electrolytes, and heat management or recycling”.

The development of advanced, functional electrodes for industrial use will pass through three generations. The goal is to build an understanding step by step of ageing mechanisms. Anode and cathodes are separately tested against reference return electrodes to optimize their electrochemical behavior. On the anode side, the first generation integrates a commercially available silicon material to improve cell energy density. On the cathode side, integrating a water-soluble binding agent improves manufacturing process sustainability and reduces costs. The next generation improves the silicon content at the anode by integrating a 3D current collector. The third generation integrates a lithium

buffer at the anode. The cathode is then manufactured at an industrial scale using a water-based process. In the last project year after technology transfer, the optimized lithium-ion batteries will be put into production. Tests and verifications will be performed to confirm the technology has reached readiness level six. The consortium is jointly planning a follow-up project. It will likely find support as well, because the roadmap for European energy storage technology development by 2030 (EASE/EERA) has established energy storage as a key technology for meeting European climate targets. Energy storage has potential applications across the entire energy value chain, from energy demand and supply to grid performance to market flexibility.

An Innovative Treatment for Multiple Sclerosis

A European consortium coordinated by the Fraunhofer Institute for Interfacial Engineering and Biotechnology (IGB) in Stuttgart is currently developing a new technology for improving the treatment of multiple sclerosis. The innovative “N2B-patch” transports a special active substance directly into the central nervous system through the nose.

As part of the EU-funded joint project N2B-patch (Nose to Brain Delivery of an API via the Olfactory Region for the Regenerative Treatment of Multiple Sclerosis Using Novel Multi-functional Biomaterials Combined with a Medical Device), researchers are designing a therapeutic approach to delivering active substances through the regio olfactoria (olfactory region). At the olfactory mucous membrane, only a few cell layers and the ethmoid bone separate the brain and its fluid from the outside world. Pharmaceutical agents are usually distributed in the body by the blood. They can enter the bloodstream either directly by injection or indirectly, for example through the digestive tract after oral ingestion. But for diseases such as those of the central

nervous system, it is crucial to transport the agents as efficiently as possible to the target site. An example of this type of disease is multiple sclerosis. Pharmaceuticals that are currently used to treat (MS), primarily target the central nervous system. But special protective mechanisms such as the blood-brain barrier make it particularly difficult for conventionally administered pharmaceuticals to reach the central nervous system by the bloodstream.

Directly accessing the brain through the nose

As a participant of the N2B-patch project, the Fraunhofer IGB is contributing to the development of a new therapeutic approach for delivering pharmaceutical agents to the brain through the nose. The researchers are working on a therapeutic system with four parts:

- the agent itself,
- a formulation containing the agent,
- a hydrogel in a patch used as a carrier to transport the formulation,
- and the applicator for inserting the gel patch into the nose.

The pharmaceutical agent contained in the gel patch is released over a long period of time. Since it eventually dissolves entirely, there is no need for removal. For long-term treatment, a new patch is then reapplied. “Within the project, researchers from the Fraunhofer IGB are focusing on formulating the particles containing the pharmaceutical agent and integrating them into the gel,” explains the project coordinator and researcher in the Stuttgart research group Dr. Carmen Gruber-Traub.

The innovative pharmaceutical formulation protects the sensitive active agents and maintains their bio-activity. “The project consortium is developing a special applicator to insert the gel into the nose. The device combines a commercially available endoscope with a special mixing system. A mixing system is required because the application site is difficult to access, and once the gel is solid it cannot be placed in that location.”

N2B-patch

PROJECT DURATION: 01.01.2017–31.12.2020

PROJECT VOLUME: 6 472 998 euros

EU FUNDING: 5 325 498 euros

PROJECT WEBSITE:

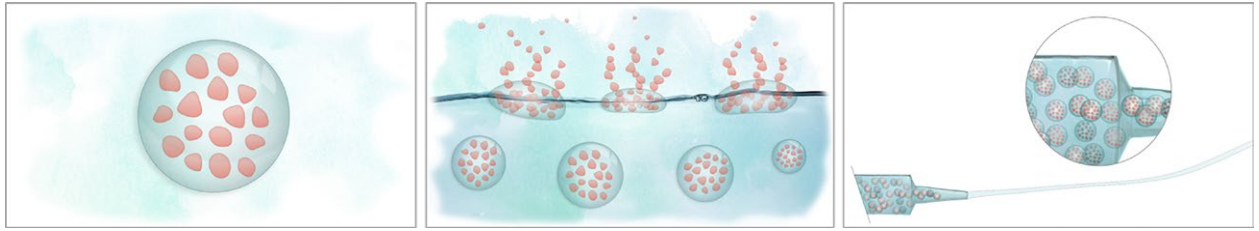
n2b-patch.eu

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- JensonR+ Ltd, UK
- LGI Consulting Sàrl, France
- The European Multiple Sclerosis Platform aisbl, Belgium
- Universität Bern, Switzerland



An ensemble including biomaterial-based drug particles and an innovative pharmaceutical agent for treating multiple sclerosis (left), the hydrogel formulation used as a carrier (center) and the applicator device, an integral component of this minimally invasive functional system (right).

EU funds N2B-patch project for four years

The four-year project will receive financial support from the EU until the end of 2020. Carmen Gruber-Traub highlights that this project is also an excellent opportunity to establish new networks. “Coordinating an EU project consortium and collaborating with partners from various areas and countries presents fascinating organizational and scientific challenges. But it also offers a unique opportunity to advance research activities on an international level and build new networks,” she said, describing the advantages of cross-border cooperation.

The international consortium includes a total of eleven partners from research institutions, industry and patient organizations all working together to achieve the project’s goals. The participants are currently focusing their research on treatments for multiple sclerosis, but they also hope the N2B platform will innovate treatments in other application areas as well. The technology could be used to treat other diseases of the central nervous system such as Alzheimer’s disease. “But for other purposes, the formulation would have to first be adapted to a different active ingredient,” says Gruber-Traub. Developing a new active ingredient combined with a new therapeutic approach generally requires several years of intensive research and validation. The N2B-patch team has initiated the laboratory work and expects to demonstrate proof of concept and preclinical validation by the end of the project. But many more years of research and testing will be required for final approval.

How to Apply for Funding

Do you have a compelling idea for a project? Can you explain it clearly to other experts? Does it comply with the formal requirements? The German NCP for Materials is available to support and guide you in preparing your funding application for Horizon 2020. German applicants can receive support from the initial phases of application development.

Application procedures and funding conditions

There are one-stage and two-stage processes for Horizon 2020 applications. The two-stage process begins with an initial project outline. If this outline is approved, the next step is to submit a full application. The funding topic determines which process is used. The work programs define the precise conditions for each funding topic. The funding rate for topics requiring extensive research (also called "Research and Innovation Actions," RIA) is generally 100 percent. For topics related to a specific application (also called "Innovation Actions," IA) the funding rate is 70 percent of direct project costs. Overhead costs are covered by a lump sum amounting to 25 percent of the direct project costs.

activities (CSAs) are also reimbursed for 100 percent of direct project costs. For grants received by these companies to research a specific application (Innovation Actions), reimbursal is provided for 70 percent of direct project costs. A 50 percent funding rate was recently introduced (called IA 50 percent) for projects researching innovation actions very closely aligned with industry requirements (e. g. developing pilot lines). For the non-commercial project partners, the funding rates here remain the same. Overhead costs are covered by a lump sum amounting to 25 percent of the direct project costs for all project types.

Tenders for materials research in Horizon 2020

Research activities related to materials science are included in all three areas of the Horizon 2020 program. Most of the activities are in the "Industrial leadership" area. The area's "Key Enabling Technologies – KET" category includes six fields of research:

- Information and communication technologies
- Nanotechnologies
- Advanced materials
- Biotechnology
- Advanced manufacturing and processing
- Aerospace

Funding quotas

Universities, colleges and non-commercial research institutes are reimbursed for 100 percent of their direct project costs incurred by collaborative research projects. Industrial companies including SMEs that receive grants for projects requiring extensive research (Research and Innovation Actions) and associated

Advice and support

The NCP for Materials (National Contact Point for the EU Program Horizon) is available to review idea papers, outlines and full proposals and make suggestions for improvement prior to submission to the Funding & Tenders Portal of the EU Commission. Applicants can receive support throughout the entire application process, from the initial idea to application submission. The service is free of charge and all information is kept confidential. The NCP for Materials assesses project ideas with a view to their relevance to the tender topic, conceptual clarity and compliance with formal requirements. The NCP then provides comprehensive feedback, including corrections and suggestions for improvement. The commentary includes an analysis of the expert Evaluation Summary Reports (ESRs) from previous calls. For tender topics including different NMBP areas (cross-KET), the NCP for Materials cooperates closely with the other relevant German national contact points. Since the NCP is in close communication with the EU Commission's scientific staff, it can also take into consideration how call topics were developed and where they fit into the EU's larger political goals when giving feedback to applicants. More information is available at nks-werkstoffe.de.

The NMP teAm

The EU-funded National Contact Points network project for nanotechnologies, materials and manufacture has an English-language website offering a comprehensive range of services. In addition to updated information on current calls for proposals as well as transnational events, the site features web streams on various aspects of the application process. Visit nmpteam.com.

The network project NMP TeAm partner search platform facilitates successful consortium formation on the current tender topics. The platform contains a large number of topic-specific profiles and project ideas. You can also list your partner offer here: nmp-partnersearch.eu

Events

The NCP for Materials organizes and participates in events offering further information and advice on the call topics in the NMBP work program. News about upcoming events can be found on our homepage at nks-werkstoffe.de.

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