HELMHOLTZ-ZENTRUM GEESTHACHT

People with Ideas

In2science

#1

Team Magazine

Helmholtz-Zentrum Geesthacht

Centre for Materials and Coastal Research


At the Centre

#1

Letter from the Editors

Dear Colleagues,

In keeping with the motto "new beginnings, not nostalgia," the Public Relations Department has invested an incredible amount of creativity and energy in recent months developing this new magazine. In2science, the new employee publication, strives to be as diverse as the research topics undertaken at the Helmholtz-Zentrum Geesthacht.

For us, In2science serves as an invitation to the scientific world as well as an invitation to feel at home within both scientific realms: materials science and coastal research.

The magazine is meant to be vivid. We therefore begin with a photographic feature on the RollMag facility utilised by magnesium researchers in Geesthacht. The impressive photos illustrate the complexity involved for colleagues at MagIC when producing magnesium bands. The considerable efforts involved in biomaterial research is described in an interview with chemist Axel Neffe. The EU project in which he is involved is geared toward developing heart implants for children.

The early summer saw a change in Climate Service Center 2.0 leadership when Daniela Jacob took the reins. In a featured personal story, we find out why the climate researcher was driven to study meteorology.

Ships are built in Flensburg using modelled data from coastal researchers. The discussion between the coastal scientist and the naval engineer is a prime example of how research results make their way into application.

We now wish you much reading pleasure.
We look forward to your responses. Please get in touch!
Your Editorial Team / In2science@hzg.de

Photo Feature

The big moment

The result of hard work

Strips made of molten magnesium are produced using the casting-rolling process. The researchers use a method in which they no longer roll magnesium forty times, but instead only three times to create the sheet. This would considerably reduce the production cost and could thereby compete with aluminium.

From left to right: J. Victoria-Hernandez, Jan Bohlen, Dietmar Letzig, Lennart Stutz, Sangbong Yi, Joachim Wendt, Stefan Koch, Gerrit Kurz, Alexander Reichart. Material researchers at the Magnesium Innovation Centre – MagIC.

The concept

The magnesium bars are melted at approximately seven hundred degrees Celsius in a furnace.

The concept: a car made of magnesium?

The scientists soon hope this light metal will serve as an alternative to the currently more profitable aluminium.
They are carrying out intensive research on the material.

Magnesium:

The metal is three times lighter than steel and one and a half times lighter than aluminium while both durable and stable – ideal conditions for lightweight engineering.

The research work

at the unique casting-rolling facility requires teamwork between scientists and technicians. The researchers wear heat-resistant gear to protect themselves from the high temperatures.

Molten metal:

Processing the magnesium is demanding: numerous rolling steps would need to be carried out at high temperatures for conventional sheet metal production. The Geesthacht casting-rolling unit achieves this goal in one step. The melted magnesium is poured directly onto the roller and immediately rolled flat.

The process

How did the material solidify?

The condition of the finished sheet depends on many factors: the alloying additions, the temperature, the rolling speed, the injection nozzles. The crucial question is always then: how can one control the solidification behaviour?

Magnesium as a material of the future:

Vehicles would become lighter and therefore more fuel efficient.
A reduction of two hundred kilograms in weight reduces fuel consumption by approximately one litre per one hundred kilometres.

The product

What happens next?

The magnesium bands produced subsequently undergo further processing by means of the hot rolling method.

Contents

The HZG Participates in a New Project:

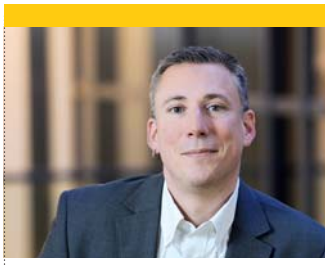
Biomaterials for *Heart Implants in Children*

More than a third of all congenital heart defects in children require the reconstruction of the heart's right ventricular outflow tract. Because the implant does not grow along with the child, the risky operation must be repeated several times. This could change in the distant future:

The EU project TEH-Tube is to develop an implant that will be absorbed with time and will simultaneously be replaced by the body's own tissue. The implant is based on a bioabsorbable biomaterial. While it remains a dream of the future, the intention, however, is to also carry out this research over a period of decades.

The development of innovative polymer-based biomaterials for medical applications presents considerable challenges for researchers. Very few polymer systems, for example, have been established for clinical use to date. This particularly applies to those materials which are meant to remain in the body only for a certain period of time before being absorbed by the body.

Such a project can only fully succeed if the entire chain of development – from design, synthesis, testing and approval – is taken into consideration. The challenge is closing the gap between the fundamental research and clinical application. This project therefore takes particular care, even at the early stages, in regards to questions of quality management relevant to certification.



ABOUT

Dr. Axel Neffe, 41

The chemist has been leading the Department of Biomimetic Materials in Teltow since 2006. He completed his university studies and PhD at the University of Hamburg.

TEH-Tube is an EU-funded research project, which began in January 2014 and will initially run for four years. Seven European organisations and research institutions are participating, among them the Institute of Biomaterial Science at the Helmholtz-Zentrum Geesthacht in Teltow. Dr. Axel Neffe leads the Department of Biomimetic Materials at the HZG.

Here you can read an interview with Neffe as he discusses the TEH-Tube EU project.

Dr. Neffe, what is the particular expertise in Teltow? Why are you involved in this EU project?

On the one hand, we are one of Europe's leaders in the area of polymer synthesis and polymer characterisation, not only in physicochemical but also in biological characterisation. In addition, we possess the special in-house capability to carry out research within what is referred to as GMP conditions (Good Manufacturing Process) and to produce the first prototypes. This means that the process and documentation is GMP compliant, which is important for approval preparation and for carrying out clinical trials. It serves to ensure that the research results can actually be carried over to the clinical realm. In Germany and in Europe there are very few research institutions in which this can be done, and we are one of those facilities.

What is the goal of the TEH-Tube project?

The goal is the curative treatment of children with a congenital heart defect in which the right ventricular outflow tract of the heart fails to function properly due to a malformation, so the heart vessels as well as the valves must be reconstructed. In contrast to adult patients, the heart grows in children but the material does not grow along with it. The operation must therefore be repeated in affected children as long as the heart is still growing. That's precisely what TEH-Tube is about: to develop a new material system so that these additional surgeries can be avoided.

How do you expect to achieve this goal of avoiding operations every two years?

We focus on using a bioabsorbable material, which means a material that will fulfil its function within the body only for a certain period of time and will then slowly be replaced by the body's own material. It should, therefore, be dissolved in the body during the same period in which the new cells are growing in the correct location. This should then result in fully functioning bodily tissue.

The operation must therefore be repeated in affected children as long as the heart is still growing. That's precisely what TEH-Tube is about: to develop a new material system so that these additional surgeries can be avoided.

What kind of material are we talking about?
It is a bioabsorbable polymer from the polyester class. The special thing about this project is that either seeding the cells on the material within the body should be specially supported or we first seed the cells on the material outside the body.

What kind of cells should be seeded on the polymer?
We use mesenchymal stem cells, which are also known as adult stem cells.

The supporting skeleton of the implant slowly dissolves in the body then?
Right. This will occur over a period adapted to the regeneration. If the material is absorbed too quickly, then it couldn't perform its necessary function long enough. If it were slower, then the material itself would prevent the growth of the body's own tissue.

What are the greatest challenges of this project?
TEH-Tube is a large interdisciplinary project. This means that various chemical, physical and biological experiments must converge, and they must bring about the correct results in all aspects. A major challenge is that we need to recognize as early as the preparation phase which key parameters are essential for the implantation to be a success. This means that we must ask: what material properties must be fulfilled? How should the design look? How should it be processed in order for the project to actually be implemented successfully? The special challenges for our institute in Teltow are the surface functionalization of the polymers and the question concerning how the polymer synthesis can be adjusted to the requirements.

What are the special roles for the Institute of Biomaterial Science?
The first objective for the Institute of Biomaterial Science is the surface functionalization of commercially available polymers. Our second task is to produce new polymers because not all commercially available polymers may be perfectly suited to our needs. These objectives are undertaken while also taking into account the quality management requirements.

Surface functionalization of clinically established polymers – can you explain that?

We don't change the basic properties of the polymers, but rather their surfaces only. For example, a material might be suitable in regards to its bioabsorption rates and its mechanical properties, but the body's cells might not bind well to this material. This means that we want to enable the cells to better adhere to the surface. One way to achieve our goal is to apply peptides that bind the cells to this polymer.

What are the roles of the partners?

A total of seven partners are participating in this project. One partner is mainly responsible for the administration side while three partners from the industrial sector and three academic partners are also involved.

The two other academic partners are the General Hospital in Paris (APHP) and University College in London. The group led by Prof. David Kalfa in Paris is concerned with studying suitable animal models in order to investigate the subject as a whole. The group also produces the stem cells required for the project. The University College London researches polymer preparation so that the polymers can be developed into the correct form. The partner roles include biological and mechanical testing as well as preparation for clinical translation and approval.

How does the TEH-TUBE project fit into the overall research activities of the institute?

The idea that biomaterials can be replaced by the body's own material in order to achieve complete regeneration is a goal towards which we work at this institute as a whole. This particular EU project fits precisely into the strategic focus of the institute.

.

Thank you very much for the interview!

Author: Erich Wittenberg
Kontakt@erichwittenberg.de

»Research is, my passion«

2008 Nordmetall-Stiftung Prize for Technology

2009 Henry Granjon Prize, International Institute of Welding

since 2010 A Helmholtz group leader for young university scientists

2011 Raiser Innovation Prize

since 2011 Assistant Professor at the Technical University Hamburg-Harburg

2013 German High Tech Champion in Lightweight Design

2014 Georg Sachs Prize, Deutsche Gesellschaft für Materialkunde / German Society for Materials Science (DGM)

Sergio Amancio has currently obtained eleven patents and has applied for a further ten

Sergio de Traglia Amancio Filho –

It's an unusual sounding name to German ears. That's because the materials engineer is a native Brazilian.

The Assistant Professor and Helmholtz group leader for young university scientists researches plastic-metal joining technology at the Helmholtz-Zentrum Geesthacht. The research can be utilised in the future, for example, in producing even lighter aircraft and automobiles. To carry out his research on friction stir welding at a leading global institution, the 38-year-old left his homeland in 2001. Together with his wife Gisele Amancio, who also works at the HZG, he braved a new start in Geesthacht.

Assistant Professor Sergio Amancio walks the last few steps to Building 31, where the HZG joining specialists work. He looks up at the sky, grey and overcast: "Yeah, that was a huge change for us," he says openly. "The lack of sunlight has mainly been a serious challenge," he elaborates, pointing to his arms which look lightly tanned in his Polo shirt. "I'm sure I used to be three shades darker. I'm actually a summer person."

A side door leads from the building, via a paved pathway, to a steel hall. The hall measures a total of three hundred square metres. The structure was just inaugurated at the end of last year and houses modern research facilities that assist the HZG scientists in further developing joining methods or implementing and testing new ideas. While still working on his doctorate in 2007, Amancio had applied for his first patent – for what is known as friction riveting, an unknown joining method at the time.

This alone led to honours, prizes and worldwide recognition in his field for the young materials researcher: "We believed in this idea from the beginning, but you don't think that something you develop yourself could lead so quickly to a patent," Amancio says, reflecting on the start of his scientific career.

Yet another of the Brazilian's ideas, Friction Spot Joining, followed shortly thereafter as well as several other developments. Most have been meanwhile patented or are in the application process. The number of his patents thus amounts to twenty-one at present. "I have a knack for new ideas," says Amancio, a kind of "Gyro Gearloose" of the Department for Solid State Joining Processes, as he searches for an explanation. Given the work he has accomplished, this sounds considerably modest. Perhaps this modesty can be explained by his personal approach to life: "I really always knew that I wanted to be a scientist. Other than that, a lot relied on coincidence." The road leading to Geesthacht, the prizes and promotions: "I didn't plan everything that way." Amancio sees it rather as a chain of fortuitous events that led to his position as Assistant Professor. "It's not some special ambition," he assures us. "Research is simply my passion, and my ideas can be realised almost one hundred percent here in Geesthacht."

"It serves as a tremendous support for us. Faith in God helped the two of us greatly in focussing our life in Germany."

He and his wife faced a wide range of changes when they came to Germany about thirteen years ago. The relocation came with some drastic transitions. "Over twenty-one million people live in the Sao Paolo metropolitan region," Amancio explains. "Hamburg is rather a city of medium size for us." And the district of Lauenburg, where the couple work and live – how did they feel about that change? From the insane traffic to the 30-kmh zones, from the high crime rate to a sense of safety, from the urban masses to the expansive landscape. "In terms of speed, it was like going from 100 to 0 for us," the 38-year-old says, describing his first impressions.
In the meantime, the two have adjusted to their adopted country and live in an apartment in Börnsen. "We've settled in nicely," says Amancio. They spend their free time going to the movies or restaurants and are active outdoors. Sergio Amancio also plays basketball weekly with a group at the HZG. An important anchor in the couple's life is their church community, where the 38-year-old plays violin and cello: "It serves as a tremendous support for us. Faith in God helped the two of us greatly in focussing our life in Germany."
And the official sign that the Amancios have settled here? They became German citizens in 2012.

Author: Vanessa Barth@HZG.de / Illustration: Luca Candotti

At the Centre

LUCAS MERCKELBACH, SVEN DRÜCKER AND DIRK STEGLICH (from left to right)

A Case for Two:
Investigations into "Gliders"

For mechanical engineering student Sven Drücker the case is closed. After numerous collision scenarios, he determined that the "glider", a long, remote controlled mini-submarine used by the coastal researchers, can damage small recreational boats. Very specific conditions, however, must be met.

He will publish the results of the investigation as a bachelor's thesis, which he has already written under the guidance of engineer Dirk Steglich in the "Simulations of Solids and Structures" department.

Sven Drücker: "I examined at which speeds the boats on the water's surface must strike the drifting glider in order to be damaged. Beginning at about ten knots, the glider, weighing approximately fifty kilograms, would likely make a hole in the boat." As a result, the coastal researcher Lucas Merckelbach now wishes to discuss the finding with the German Maritime and Hydrographic Agency. This colleague in the "Coastal Oceanographic Measurement Systems" department launched the study to simplify the approval process for glider operations. "This unique construct, a study funded by the coastal researchers and supervised by the materials scientists, results from our expertise in the field," explains Dirk Steglich. Lucas Merckelbach elaborates the concept: "Real tests with the glider would be far too complex and expensive." The scientists therefore wanted to simulate the boat and glider movements. "We coastal researchers, however, couldn't have done these calculations ourselves," Merckelbach says.

His colleague Albert Werner was aware that Dirk Steglich was involved in modelling. The two quickly agreed that a joint bachelor's thesis would be the best way to solve this glider "mystery". Drücker therefore took up the case and went in search of clues, using the finite element method, a numerical process for solid body simulations.

The table is set for *Microalgae*

The taste of Chlorophyta: carbon dioxide and sunlight.

The green algae uses both carbon dioxide and sunlight to reproduce in its glass palace in Hamburg-Wilhelmsburg. Only about four micrometres in size, the algae shares its home with millions of others from its species. A façade measuring about two hundred square metres houses algae reactors made of glass. The futuristic "Algae House" was constructed for the 2013 International Building Exhibition. The algae is grown within the façade to produce biomass, and the algae masses later produce energy in a biogas plant. The carbon dioxide that serves as food for the algae comes from what is known as flue gas produced during natural gas combustion by the in-house heating system. The flue gas is initially highly concentrated and then added to the culture medium for the algae. In order for the algae to always find the table set and ready with sufficient carbon dioxide from the flue gas, the plant developers, SSC-Strategic Science Consult, cooperated with membrane scientists from Geesthacht.

SSC Managing Director Dr. Martin Kerner was himself a scientist at the Helmholtz-Zentrum's predecessor, the GKSS Research Center, until 1996. The carbon dioxide permeable membranes increase the concentration of the gas from nine to forty-five percent by volume in the gas flow, which is supplied to the nutrient solution.

The principle is simple: the flue gas flows past the membrane. The material is selected in such a way that it possesses a high affinity for carbon dioxide. The carbon dioxide molecules therefore migrate into the membrane, dissolve there and are released again on the other side through low pressure conditions. The molecules are sucked up at this stage and are served as food for the algae.

Bon Appétit!

Increasing the Female Quota

The HZG's personnel policies were again awarded the "career and family audit" certification this past June.

But neither the Directors, the Equal Opportunities Officer Elina Valli, nor the Human Resources Department want to rest on their laurels: new target agreements were decided.

The greatest objective in the coming three years is to hire more women in scientific management positions. The outlined measures include assisting managers re-entering the workforce after maternal or parental leave by temporarily allowing part-time work hours or by providing opportunities to telecommute. In addition, the overall number of professional women increases the number of dual-income households in Germany. This prompts us to enhance the dual career approach, which means that we support partners of new hires. The decision to relocate often depends on whether professional opportunities are available for the partner in the new city.

Better child care options are planned for school children. This includes, for example, learning facilities that might be introduced as well as a cooperative network with schools so that children who speak a different native language can quickly be integrated. The permitted range of working hours should also be extended from 6:00 a.m. to 8:00 p.m. and flexible working time accounts are to be introduced so they are suited to meet employee needs.

new buildings

2014 Construction begins on the Biomedical Technology Centre III extension in Teltow
> Completion 2016

2015 – Construction begins: on the Polymer Technology Centre (PTC)/Hydrogen Technology Centre (HTC) in Geesthacht
> Completion 2016

2015 – Construction begins: on the Coastal Competence Centre (C3) in Geesthacht
> Completion 2017

2016 – Construction expected to begin: Engineering Materials Science Centre (EMSC) in Hamburg, a building to be shared with the Photon Science Centre (DESY)

2015 – 2019
Special measure planned: Magnesium Biomaterial Centre (MBC)

The Year 1540

Extreme Drought Not to Be Found in Models

A research group under the leadership of Bern University scientists has recently published evidence that it was substantially drier in Europe during the year 1540 than during any other recorded period spanning the last hundred years, including the "summer of the century" in 2003.

Altogether thirty-two scientists took part in the published study, including Dr. Eduardo Zorita and Dr. Sebastian Wagner from the HZG's Department of Paleoclimate.

The Swiss researchers have reconstructed the number of rainy days and the amount of precipitation based on historic documents gathered from European archives. The result? A severe draught reigned over Europe in 1540. In this project, the Geesthacht climate researchers investigated to what extent different climate models can simulate this extreme weather event. They tested five different models for the project. "They provided no data for a drought in 1540," explains Eduardo Zorita. "Climate models aren't perfect. Everyone knows that. Now we know that you need to be extremely cautious with extreme events if you use models." The inaccuracy leads the climate researcher to the understanding that the causes of extreme events are not really known. Perhaps there are feedbacks between soil moisture and the atmosphere which are insufficiently covered by the model.

The statement that extreme weather events are not purely anthropogenic has raised public attention and rallied climate change sceptics. Zorita responds: "Scientists observed a regional weather phenomenon. Our tests ultimately make a statement about fine-tuning the climate models based on proxy data. The analysis in this study offers no information on whether these weather phenomena will occur more frequently with anthropogenic climate change in the future or not."

World View

Approximately 190 international scientists currently work at the Helmholtz-Zentrum Geesthacht. These visitors come from all over the world: fifty-seven nations are represented. In the "World View" column, they offer us their personal insights on the topics that motivate them.

LAHORE

Lahore, Pakistan
7,092,000 Inhabitants
Area: 1,172 km2
Located on the Ravi River
Weather 37 °C
Wind from the NW with 11 km/h, 44% humidity

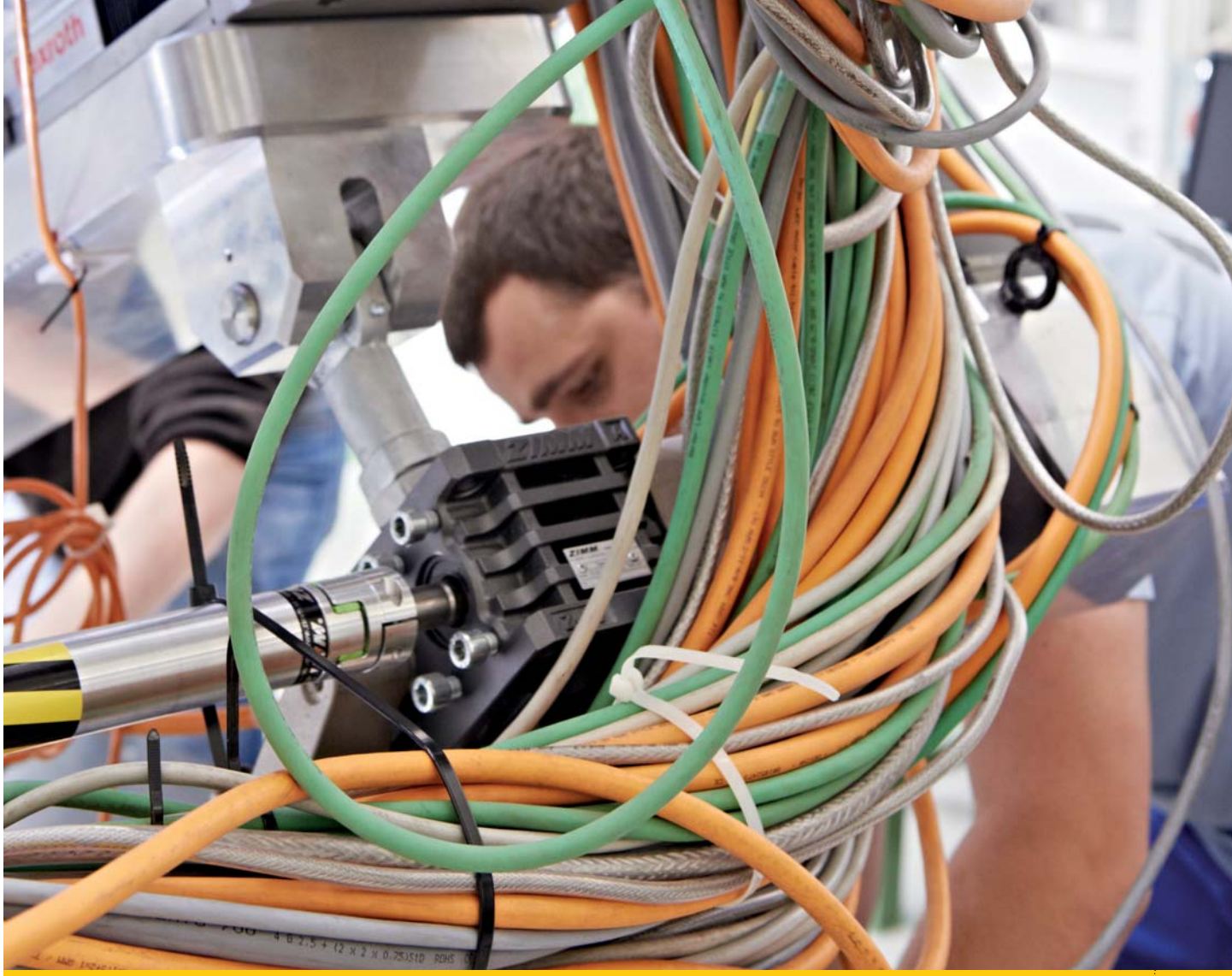
One well-travelled researcher is Aurangzeb Khan, who hails from Pakistan. For the last four-and-a-half years the doctoral candidate in the Department for Ecosystem Modelling has lived in Geesthacht with his wife Ayesha and children: [Abdulmoiz (7), Maira (4) and Arfa (6 months)].

"I certainly recommend a research residency accompanied by one's family here in Geesthacht."

The city, with a population of approximately 30,000, is a good size and has everything you need to live comfortably. I'm around seven thousand kilometres from my hometown of Lahore, Pakistan and I feel at home here when I walk or bike through the streets and come across people I know. It was a good decision for my wife and son to join me during my research related stay at HZG. My son went to the Einsteinchen kindergarten here and now attends primary school in Geesthacht. I find it interesting that children begin schooling so late in Germany unlike in Pakistan where children are usually enrolled in pre-school at the age of three. My wife, who is a physician by profession, is of the view that early childhood education is very important to children. What we found even more surprising was that my son wasn't first taught the alphabets for instance, but how to cut with scissors. It's quite different in Pakistan, where pre-schooling is much more academically oriented. In Germany, playing is far more pronounced in kindergarten, with less emphasis on learning. But children can also learn a lot while playing, especially about social interactions. Even if we were initially surprised by the pedagogical approach, we were really very content. The Einsteinchen kindergarten is well equipped and organised. I've also changed my opinion a little about what age schooling should begin. Keeping in view the pace of education from class 1. I think the age of six is too late. Schooling can begin at five or a little bit younger ideally.

From a non-academic point of view, my family has always appreciated the inexhaustible opportunities to visit nature in the immediate surroundings of Geesthacht. Some highlights of our summer activities include biking together around the Elbe river, visiting the Geesthacht open-air swimming pool and weekends spent picking up fresh berries directly from farms. We never experienced snowfall and its related winter adventures in our hometown, Lahore. I would advise those who assist visiting scientists that it would be nice to inform people far in advance of what needs to be done: begin early in ensuring a spot at the kindergarten, the school or in finding an apartment. You should start at least three months before your planned stay. There are many more tasks to take care of once you arrive, such as finding a telephone company or an energy provider. It would also be nice if, perhaps, before arrival one could get in contact with other scientists who find themselves in a similar situation. Then there would be a type of international network in place where members could exchange essential tips and tricks via email in advance. Facebook community pages of HZG can help getting in contact more informally. The HZG's Welcome Brochure is helpful as an introduction, but it could be expanded with a few more details. A list of mosques in the area or shops in which you can purchase typical spice mixes like masalas could be helpful for instance.

Author: Aurangzeb Khan



Contents / Part II

In Conversation

The Perfect Form for *Pauline & Yasmine*

ABOUT

Dr. Katja Wöckner-Kluwe, 33

The marine engineer studied at the Technical University Hamburg-Harburg, where she completed her doctorate in 2013. She has been working as an engineer at Flensburg Shipbuilders since 2012.

Dr. Ralf Weiße, 48

The coastal researcher studied meteorology at Humboldt University in Berlin and earned his doctorate at the University of Hamburg in 1994. He has been working at the Helmholtz-Zentrum Geesthacht since 2000. Since 2001, he has been leading the Department for Coastal Climate at the HZG.

Katja Wöckner-Kluwe and Ralf Weiße at the Flensburg Shipbuilders shipyard.

Using “weather hindcasts” we can gain insight into the future: ships of tomorrow are built in Flensburg with the help of weather data from the past. The weather models developed by coastal researchers in Geesthacht allow us to draw conclusions on the seaworthiness of ships before they are built.

Marine engineer Dr. Katja Wöckner-Kluwe utilises data from the Institute of Coastal Research in her work at the Flensburg Shipbuilders to, for example, develop safer ships or to develop ships that take into account passenger comfort as well as the required seafaring characteristics of the vessels.

The data project coastDat has made its results available to designers for simulating ship movement for several years now. Cooperation began between the coastal researchers and the Flensburg shipyard in the early 2000s. The designers at the time sought sea state data for the North Sea. They specifically wanted data for a planned ferry route between Immingham, England and Zeebrugge in Belgium. The Flensburg team wanted to know what wave heights could be expected in the region. This exact data had already been determined by coastal researchers in the predecessor to the coastDat project, HIPOCAS.

Ralf Weiße, coastal scientist and leader of the Coastal Climate Department, remembers:

The designers asked themselves how often they would need to fasten or secure the freight and, if so, would they need any additional stabilisers.

Katja Wöckner-Kluwe elaborates: “Though I didn’t cooperate on this project, I know that data was sought at the time so they could examine virtual ship travel through sea conditions on this route.“

The coastal researchers’ meteorological data are used for this purpose in the shipyard’s simulation software. The software calculates the anticipated movement of the ship based on the coastDat data. In the case of Yasmine and Pauline, the two cargo ferries planned back then, the ships were custom-made for the England route. Because time is money in modern shipping, securing the lorries on deck means delays.

Katja Wöckner-Kluwe: “With a customized design of the hull shape or by using other measures such as roll damping stabilisers, we can improve the seaworthiness of the ship.” The ship schedule then becomes more accurate or the vessel can lie in the water with more stability, depending on the requirements.

Safety aspects also play a role in the design of the ship: for the ferry currently in the shipyard that will be traveling in the waters off Scotland, the marine engineer wanted to know the speed and force at which the water would hit the bow door, which is located at the front of the vessel.

Katja Wöckner-Kluwe: “We calculated the relative speed between the waves and ship. From that data, we could determine the force on the bow door. In order to do so, we looked to our simulation: we examined in which sea conditions particularly high relative velocities could be found as well as the forces that accompanied these speeds. The dimensions of the bow door are then determined by these forces.”

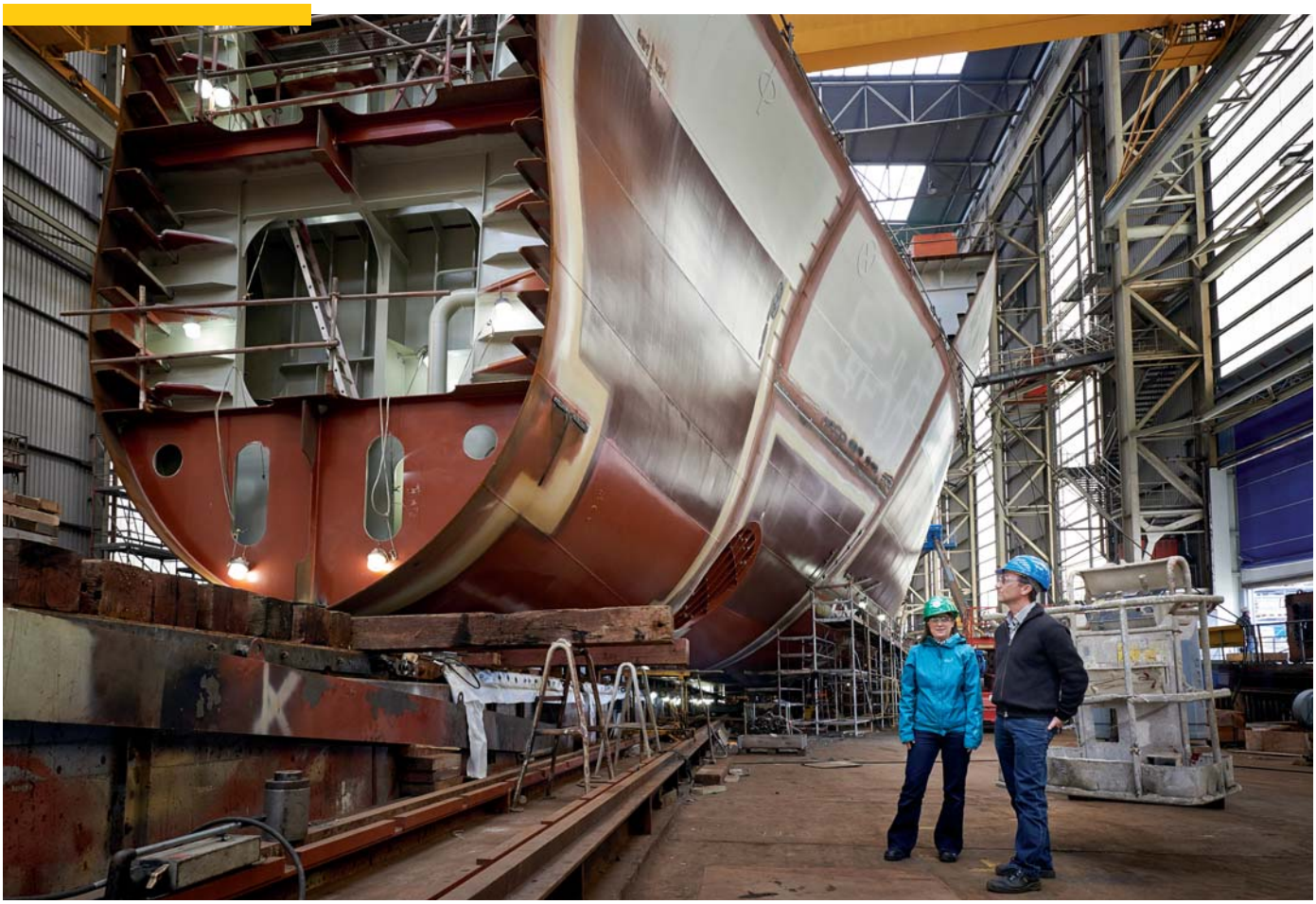
Almost ready for voyage the bow door on this new ferry is based on preceding calculations.

These safety calculations are also made so that an accident like the Estonia never happens again. After the 1994 disaster, in which almost nine hundred people died, reports determined that the Estonia's bow visor was torn off during heavy seas and from the resulting forces.

Data for shipbuilding was rather a by-product in the coastDat project, or it's forerunner, HIPOCAS. The Geesthacht scientists originally wanted to know how storm tides or extreme sea conditions change over long periods of time in the North Sea.

Ralf Weiße:

There is very little data available. Isolated data exists from measurement buoys or stations on the open sea, but there are no continuous measurement series covering several decades that were gathered using the same methodology.



With which wave heights should we calculate? Katja Wöckner-Kluwe and Ralf Weiße discuss the data on-site.

This can lead to misinterpretations. Changes, for example, in measurement methodology can lead to simulated trends that don't exist in reality. In addition, there exists natural climate variability over periods of forty to fifty years that show no tendency one way or the other."

Scientists worldwide therefore developed methods to obtain the most precise information possible for regions where very few measurements exist. The technique, which has gained acceptance in situations where there is little data available, is based on combining the models with the measurement data. The coastDat data set is also modelled on such an approach. Based on global model calculations, in which existing measurements were integrated, the HZG researchers develop scenarios dependent on their numerical model simulations for locations in which there are no real measurements.

Ralf Weiße:

We provide information about parameters such as wind or wave height based on the numeric models. Ultimately what results, for example, are wind and wave direction frequency distributions. So we basically create a weather forecast in reverse.

Katja Wöckner-Kluwe

We are extremely interested in sailing our ships in a virtual Baltic Sea as well as other regions in the future. We also get inquiries from customers for ships that will sail there.

Success: the coastDat data set can display the climatological sea state from 1958 to today. It produces a virtual North Sea for the past fifty to sixty years. One important finding that the coastal scientists derive from this research is that storm activity over a period of decades is subject to considerable variability, but no long-term trend can be discerned. Nevertheless, storm floods are about twenty centimetres higher than one hundred years ago. The scientists attribute this to the average sea level rise, which causes the base level for storm floods to generally be higher today.

Data from coastDat cannot only be utilised in terms of climate changes in the marine environment and for ship design adaption, but the statistics are also interesting for the planning and logistics of offshore wind parks or for risk assessment. Other regions are of further interest.

Who knows, perhaps there will soon be ships traveling on the Baltic Sea that have been optimised based on the HZG data. That would certainly please coastal scientist Ralf Weiße. “We were there when Yasmine launched. That was an uplifting moment when our data made it into the form of the ship on the water.”

Author: : Heidrun.Hillen@hzg.de

“I knew then: that was the right job for me.
When I grow up, I want to study meteorology!”

Portrait

Freedom & Responsibility

– What Drives Climate Researcher Dr. Daniela Jacob?

Photo Credit: istock/Nicole Keller

The Wasserkuppe is the highest peak in the Rhön Mountains. A sort of amusement park for anything you could desire in the sky: paragliders, gliders, kites. It is here that Daniela Jacob begins her ascent.

She is fourteen years old, too young for a moped licence – but she can already steer the glider on her own. “There was this man from the Deutschen Wetterdienst (German Weather Service). He worked at the weather station in the mornings – and in the afternoons he could fly,” she says.

“I knew then: that’s the right job for me. When I grow up, I want to study meteorology!”

When the IPCC World Climate Report was published on April 5, 2014, only one German scientist's name was listed among the authors – that name was Daniela Jacob. She appears on Reinhold Beckmann’s talk show to explain climate change. Since June, she has been provisionally heading the Climate Service Center 2.0 (CSC), an independent scientific organisational unit. A professional calling at a young age, a successful carrier – looking back at both phases of her life, you realize it’s the stuff movies are made of: from the excited girl counting the hours of rainfall in her garden’s weather station, diligently transferring the data in the evenings to a notebook. “No, no,” Daniela Jacob says, laughing. “I wasn't involved with all that as a teenager. That was a plan for after I finished secondary school.” Well, anyway: she chose math and physics as her main courses of study. Numbers are her friends. She begins her university coursework in Darmstadt. “In the beginning, though, I was more concerned with politics than meteorology,” she confesses. Instead of sitting in the library, she serves as Student Parliament President and, in 1983, founds a national student meteorology conference, Bundesfachtagung für Meteorologie. This conference still exists today and is commonly known by its shortened name: "StuMeTa”.

According to the philosopher Socrates, we can only find happiness when we follow our inner voice.

But what are the motivating factors driving Daniela Jacob? University studies instead of apprenticeship; student council work instead of bookish endeavours; research instead of a secure job at the Deutschen Wetterdienst – Daniel Jacob explains: “Those were all decisions in favour of freedom.” She founded a wind energy consulting firm with a colleague in 1990. She was still a doctoral candidate at the GKSS in Geesthacht then. She has since handed over direction of the firm to her husband. Wouldn’t there have been more freedom in the industry than in research? Her reply is quick: “Well, that was the only time I’ve ever changed my mind about that and the topic was a decisive factor.” The CSC is located in central Hamburg. From the window of the Chilehaus building you can see Burchardplatz down below, where passers-by queue up for bananas and salmon filets. You can spot flashes of sunlight from between the clouds. “The weather actually doesn’t interest me at all,” Jacob explains, raising her left eyebrow as she always does when mixing humour into the conversation. “Climate, on the other hand, interests me immensely. I want to think ahead, about what might happen, then ask myself how we can best deal with the situation.” To shape something, leave something behind – that's her second motivation. That is why she decided in favour of research and against a life as a business woman:

“Science can more easily create the stimulus for concepts that alter society than can the private sector.”

Some of these impulses have already come up in real life: when the dykes are updated today on the North Sea or in Bavaria, a “climate supplement” is automatically ordered: the dam will be built a bit higher. “This only occurs because we, the climate researchers, demanded it.” Her third motivation, which is shared amongst nearly all other scientists: you want to have a ‘baby’. A discovery which is bound up in your own work. Daniela Jacob calls this baby REMO. This is the name of the regional climate model she developed. Using her model, you can predict how the climate is likely to change in the coming decades – and why this development could somehow be different for Hamburg than for Geesthacht.

“REMO is operational today and is used by forty institutions worldwide. It is actually one of the best regional climate models, both stable and usable. I’m proud of that.”

Follow your own path – for Jacob that always meant paying attention to your own freedom. Use science for the future. Develop models and institutions that can then be passed on to others. It is with this in mind that she leads the CSC, not coincidentally the institute that was founded so that scientific knowledge could be passed on to society. And there’s something else, something important to her as a boss: do not schedule meetings before 9:30 a.m. if possible. Plan as few workshops as possible on weekends. Daniela Jacob is mother of a 16-year-old daughter.

"Family and research – I find that having both should be possible.”

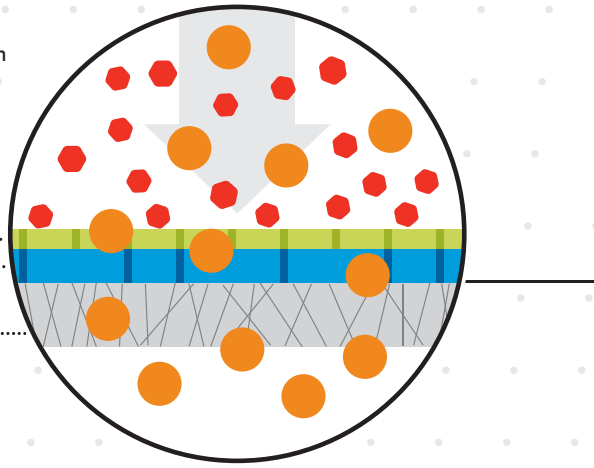
Author: Journalist Jochen Metzger

The Separation Experts

The Geesthacht polymer researchers map the entire membrane production process. They create the material, evaluate it in the laboratory and subsequently produce the membrane. Used in modules, they will be tested on an industrial scale.

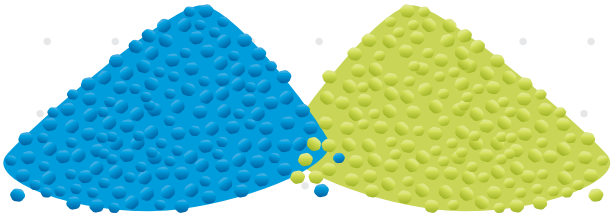
MEMBRANE

The membrane produced in Geesthacht consists of a porous carrier material and an incredibly thin separation layer. The separation layer does not function like a sieve, but rather consists of a polymer in which the solubility of one material is greater than the solubility of the other components.



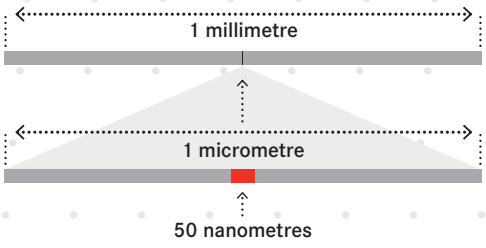
BASIC MATERIALS

Silicon, polyester and polyacrylonitrile serve as a base. They are liquefied in a solvent and can then be applied as a thin layer.



PROPORTIONS

From millimetre to nanometre

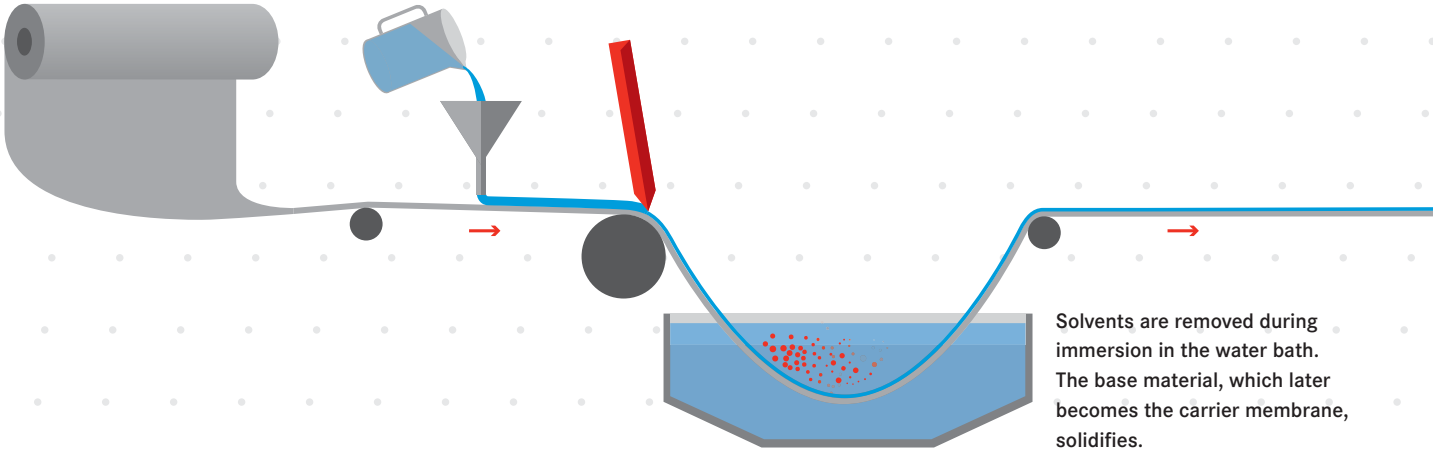


THE EXPERIMENTAL DESIGN PROCEDURE

The non-woven, the first carrier layer, is introduced from a roll measuring seventy centimetres wide.

The first base material is applied to the non-woven.

The thickness of the coating is determined with the doctor blade.

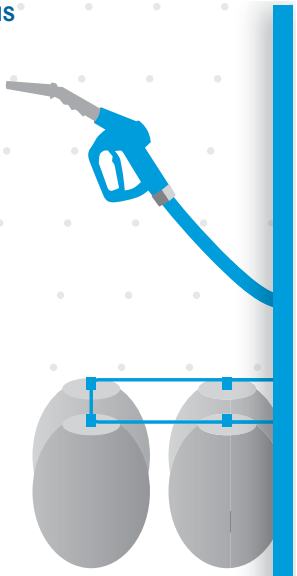


Solvents are removed during immersion in the water bath. The base material, which later becomes the carrier membrane, solidifies.

MEMBRANE TECHNOLOGY APPLICATIONS

FUEL VAPOR RECUPERATION

When the tank is filling with petrol, the toxic gases are captured, with the membranes carrying out the primary work. Hundreds of storage tanks and petrol stations worldwide have been equipped with these membrane modules since 1990.

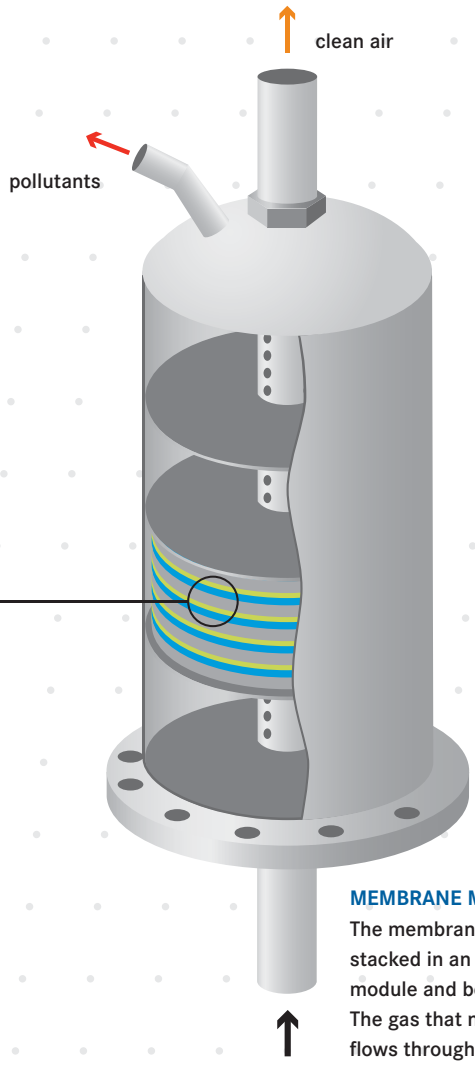


BIOGAS TREATMENT

Biogas contains up to forty percent CO_2. In order to feed the biogas into the natural gas grid, it must be cleaned with the help of membranes. The CO_2 molecules migrate into the membranes, where they dissolve. Using low pressure on the other side, the CO_2 is released again and captured.

REDUCING NITROGEN OXIDES

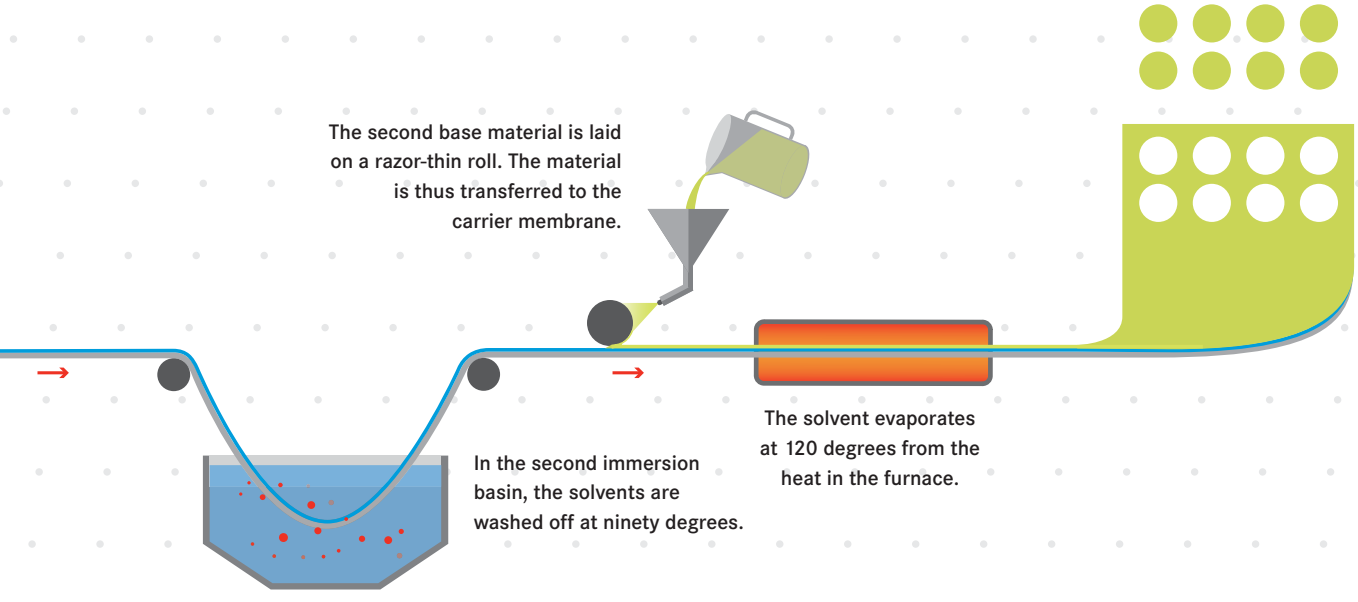
The membranes separate a portion of the oxygen before combustion in the engine. By increasing the nitrogen proportion, the temperature is reduced in the motor cylinders, which means a drastic reduction in nitrogen oxide formation.



MEMBRANE MODULE

The membrane envelopes are stacked in an airtight stainless steel module and become active here. The gas that needs to be cleaned flows through the envelopes.

Forms are cut from the finished membrane according to the particular requirements. Stacked one above the other, sealed and packed in envelopes, they are placed into the separation unit, also known as the membrane module.



The second base material is laid on a razor-thin roll. The material is thus transferred to the carrier membrane.

The solvent evaporates at 120 degrees from the heat in the furnace.

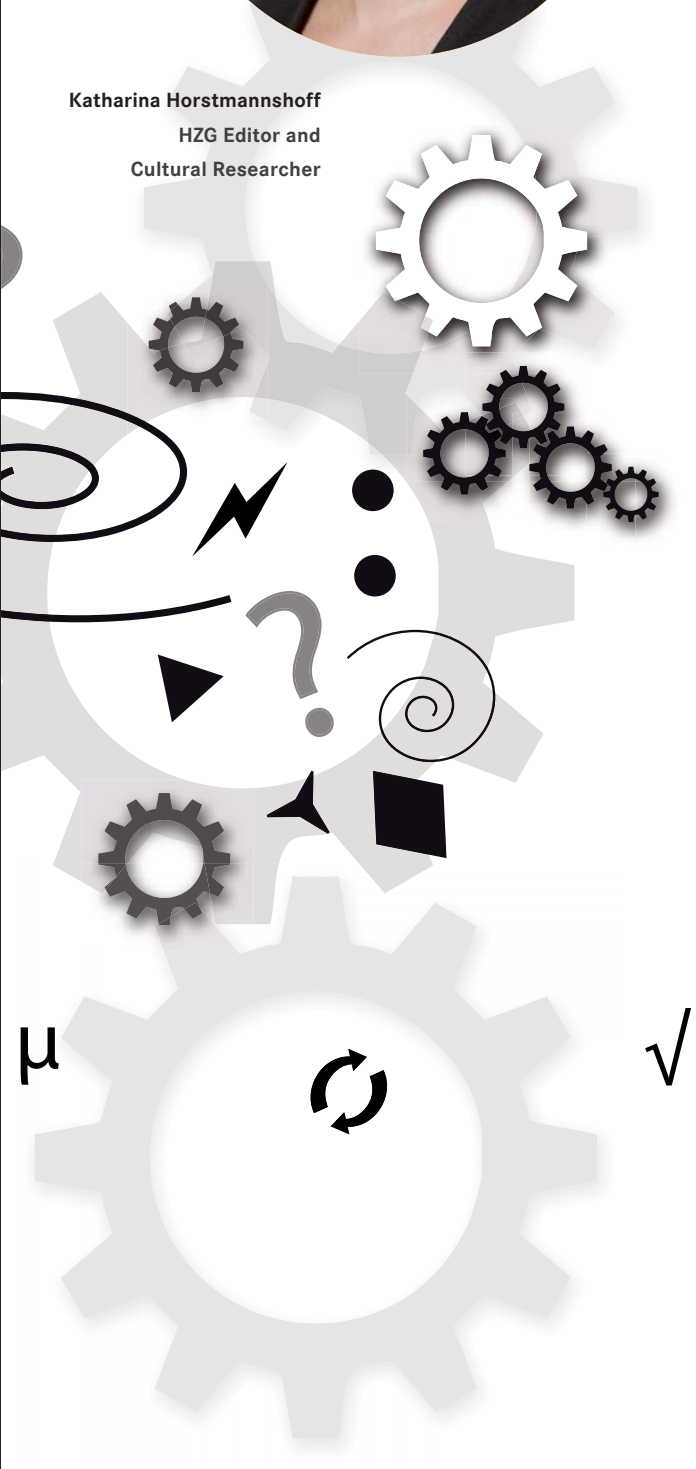
In the second immersion basin, the solvents are washed off at ninety degrees.

The National Academy of Sciences Leopoldina, the National Academy of Science and Engineering ("acatech") and the Union of German Academies of Sciences have all called for better scientific communication in Germany.

The academies published a joint report in June 2014: Structuring Communication Between Science, the Public and Media.

Opinion: *PR & Science*

Katharina Horstmannshoff
HZG Editor and
Cultural Researcher



ABOUT

Dr. Simone Rödder from the KlimaCampus Hamburg is a sociologist whose research focuses on scientific communication. She comments on the essential points of the report here.

Katharina Horstmannshoff in conversation with Dr. Simone Rödder

Ms. Rödder, your expertise has been integrated into the report. What do you think of the final version?

I find the proposal to anchor scientific communication in the recommendations for good scientific practice very positive. The statement that scientific communication also belongs to scientific practice is an important sign.

In dealing with media communication, is it necessary to advise scientists in observing standards of good scientific practice ?

Scientists who have contact with the media for the first time are often ill prepared. When dealing with the press, it is important to avoid exaggeration. It is also important to refrain from concealing uncertainties or problems involved in one's work, otherwise this could lead to undesired false alarms and media hype.

Scientists must understand that journalists have a tendency to simplify and condense material.

The academies recommend sanctions against those who violate good scientific practice in communication with the media. What do you think?

That's difficult to address because attribution problems arise. Concealing uncertainties and failing to present conflicting evidence would be considered a violation of good scientific practices. So I have to ask myself here, how can we differentiate between what the scientist failed to say or what the journalist failed to write?

Climate research has frequently come under criticism lately.

This, of course, is extremely relevant for climate research. Due to its highly political nature and media interest, the room for various intra-scientific positions is smaller than is good for a specialized debate. For a long time, a consensus has been presented in communication with the public, which really doesn't exist within the field of study. Controversies over deviating data or errors, which always occur in research, were not communicated openly. The ideologisation – in science too – is seen as a reaction to climate change sceptics. The credibility of climate research has suffered from this behaviour.

The internal evaluation criteria for scientists are to be revised. Why?

The way incentives work now is based on how much and how quickly one publishes. Sometimes this leads to the publication of fragmented work to increase the number of publications. Sometimes the work is published several times in only slightly altered form. This is irritating for the reader and a burden on the systems of communication. If you ask me about the situation, I'd say that you should slow down the whole incentive mechanism so there is no longer the pressure to publish as much. The end result is that peers must judge how significant the particular scientific effort is. The number of publications shouldn't be the deciding factor.

The authors of the report discuss another criterion for evaluation: what is known as the "media attention indicator". What do you think about this aspect?

I think this incentive is entirely wrong for scientists. You can't compare the media presence of a sinologist with that of Prof. Hans von Storch. You'd wind up with very strange results. There would then be an incentive for scientists to take on research topics that would be enticing to the media and to ignore research that's more difficult to communicate – from a scientific point of view, this would result in a loss of autonomy.

So, does that mean there should be no incentive system for scientists to involve themselves in stronger public engagement with the media or in public relations?

From the view of the public as well as from public relations there are, of course, advantages when the scientists are motived by such engagement. Many people get involved in events that aren't connected to mass media. Events for children or open houses are very popular. They do it because it's fun. I think that prizes – prizes with considerable monetary awards – would be a good way to reward engagement and to motivate passive individuals.

The report is available for download on the academies' websites.

Consulting Between *Science and Media*

The report primarily expresses recommendations for cooperation between journalists and scientists.

University and research institute press offices therefore fulfil an important function as advisor and mediator between two worlds. “I was working as a scientist in marine biology and I’ve produced television and radio features concerning scientific topics on WDR and NDR. I’ve also written books for children and possess many years of experience on the editorial staff at various newspapers,” says Dr. Torsten Fischer, explaining his professional background. He directs the Press and Public Relations Office at the HZG. Torsten Fischer:

“That’s the way it is with many of my colleagues; they possess similar experience and understand the needs of both professional groups as they assist with the balancing act between comprehensibility and scientific accuracy.”

The Department of Press and Public Relations at the HZG establishes contact with the media and the public, helps makes science comprehensible and alerts individuals about misunderstandings in communication. In order to pass on this expertise, the department regularly organizes a media training event for scientists.

Apart from answering the question “what makes my work exciting to journalists?”, our training also entails presenting topics comprehensibly and to the point in front of cameras. "We are now putting together the program for the next seminar and will post the information on the intranet soon. We also consider media training as an invitation to co-operation,” says Fischer.

Approximately ninety employees volunteered
their “heads” for the inside cover of this magazine.
The editors thank all those who contributed images.
The portraits were taken during the photo shoot in
Geesthacht for the re-launch of the internet website.

A bit of extra information: for colleagues who
would like to see their story published here,
please contact the editors at ln2science@hzg.de.
We also cordially welcome suggestions,
praise or criticism. Please contact us any time.

We look forward to hearing what you think about our first issue of* ln2*science.

Imprint

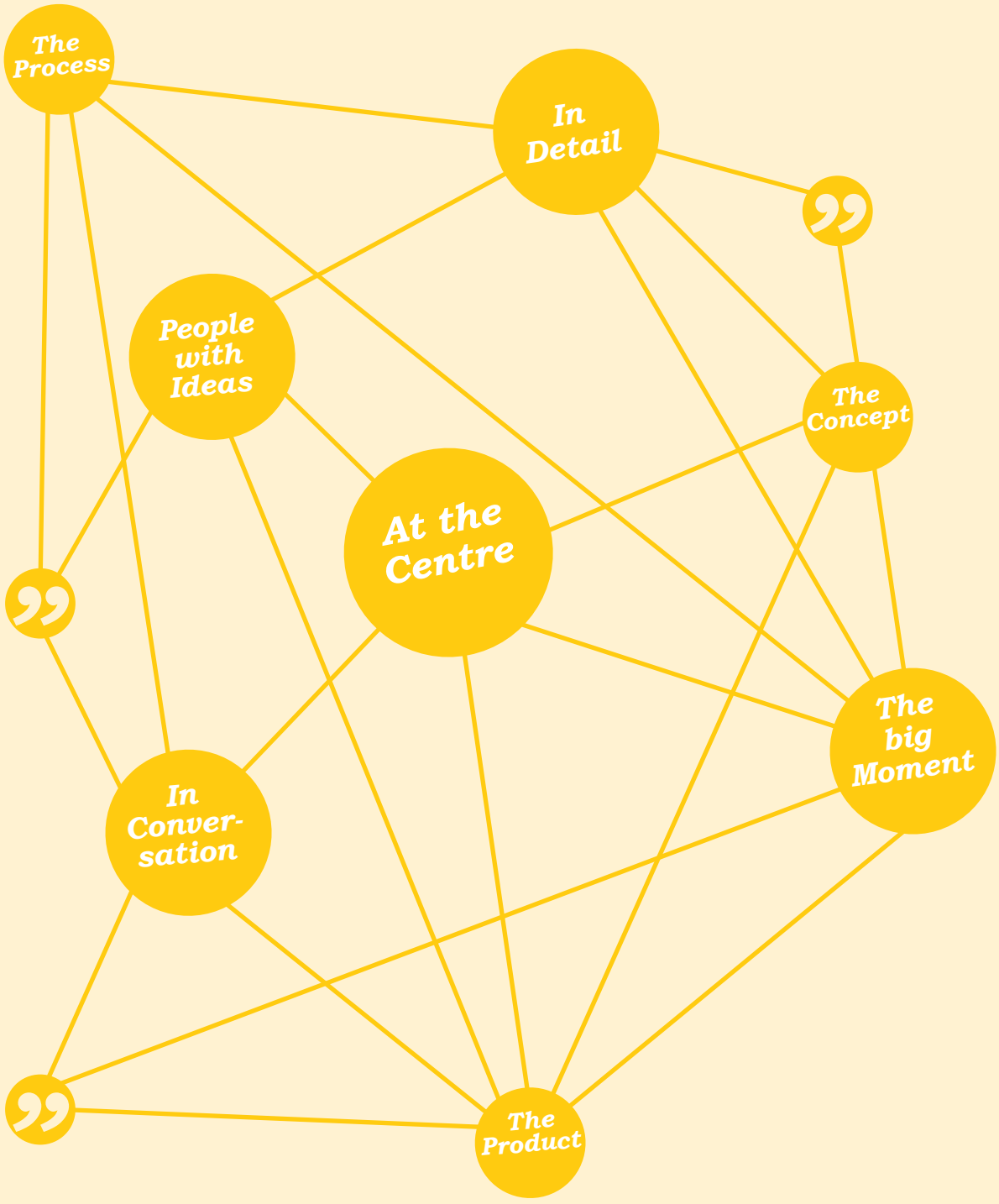
In2science Team Magazine published by the Helmholtz-Zentrums Geesthacht
E-Mail: In2science@hzg.de

Publisher: Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research GmbH
Max-Planck-Str. 1, 21502 Geesthacht, Phone +49 4152 87 1648, Fax +49 4152 87 1640

Image Copyrights: Cover and pp.1-9, pp.14, 19-25, p.31, p.35 C.Schmid/HZG; p.10 A.Astakhov/Fotolia; p.11 E.Fesseler/HZG; p.16 H.Hillen and G.Helbig/E.Karandaev/Fotolia; p.17 A.Burmakin/Fotolia; p.18 K.Horstmannshoff und naiyyer/istock; p.26 N.Keller; pp.28-29 J.Stiehler; p.30 C.Oner/istock; p. 30 Lella/Fotolia; p.31 private; p.33 C.Schmid/HZG and F.Bierstedt

Senior Editor & Editor-in-Chief: Heidrun Hillen, Dr. Torsten Fischer (responsible for content as defined by press law)
Contributing Editors: Vanessa Barth, Katharina Horstmannshoff, Jochen Metzger, Erich Wittenberg
Design: Meike Teubner, noclouds, Designteam für Marken und Kommunikation www.noclouds.cc

Printing: Helmholtz-Zentrum Geesthacht in-house printing
Paper/ Envirotop (produced from 100% recycled paper, Blue Angel certified (RAL-UZ 14))



Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research