# ACHEMA



MAGAZINE

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#### Dear readers,

ACHEMA turns 100 this year - yay! As the organisers, we are a little proud of course, and why wouldn't we be? Events that have been around as long as ACHEMA are few and far between. That's no reason, however, to rest on our laurels. We do reminisce a bit on pages 18 and 19, where you can travel with us through 100 years of trade show history. Enjoy even more pictures and footage from 1920 until today on our Instagram account @ACHEMAofficial. And why not post your very own memories of bygone times with the hashtag #100YearsOfACHEMA? Browse through your archives and share the bounty with the community!

Apart from that, we are working diligently on making the next ACHEMA as fresh and exciting as if it were the first of its kind, while keeping the spirit of our founding father, Max Buchner. At his time, chemistry and engineering were strictly separate fields; consulting each other was simply not done. Buchner's concern was to encourage chemists and engineers to collaborate. A hundred years on, his idea is as relevant as it was in 1920, with a wider scope, of course. In its 101st year, ACHEMA 2021 will continue to bring people together to explore, advance and share new ideas across industry boundaries.

Yours,

Marlene Etch

Marlene Etschmann Editor-in-Chief

# WANTED: INNOVATORS, CREATORS, DOERS

Entrepreneurial scientists, young founders and owners of start-ups can now apply for the 2021 ACHEMA Start-up Award. For the first time, participation is also possible for international founders.

ave you ever thought about founding your own company? If you are a process engineer or chemist, chances are you have not – and it is even less probable that you actually went ahead and became an entrepreneur.

That's all the more regrettable since the chemical industry is a driver of innovation for numerous other industries. Innovations in chemistry, process engineering and biotechnology can fundamentally improve technologies and products on a broad scale. However, the number of new companies being founded in these areas is low.

The reasons are manifold: a lack of inspiring role models, little economic education, the alternative of well-paid and safe corporate jobs, the high investment and time to market for chemical processes are all factors that stand in the way of a thriving chemical start-up landscape.

People with good ideas as well as young companies need support in order to bring innovations to the market and open up new business fields. This requires access to experienced mentors, a strong network and financial resources.

Therefore, DECHEMA, the Business Angels FrankfurtRheinMain and High-Tech Gründerfonds are awarding the ACHEMA Start-up Award. For the third time, they are looking for ideas, concepts and business plans in the fields of chemistry, process engineering and biotechnology. Idea providers and company founders can apply now:

The competition has three phases–ideas can be submitted until 31 March 2020, concepts until 31 July 2020 and business plans until 30 November 2020.

Particularly in the early phases, applicants have the opportunity from the outset to discuss their concepts with high-ranking mentors with specialist expertise and, on this basis, to obtain support for the preparation of their business plans. Already in this early phase, applicants as well as young startups founded or in the process of being founded after 1 July 2018 can be brought into contact with potential investors in order to discuss the possibilities of financing. Irrespective of the time of entry into the competition, all business plans submitted by 30 November 2020 will compete for the places in the final round.

BUSINESS PLANS

until 30 November 2020





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Ø\_ACHEMA.DE/START-UP\_AWARD

#### THE COMPETITION HAS THREE PHASES – IDEAS CAN BE SUBMITTED



#### WHAT'S IN THE POT?

Up to ten promising start-ups or start-up ideas will be given the chance to present their offerings at the ACHEMA Start-up Award stand and within a special pitch and networking session – a unique opportunity to gain visibility with a huge international expert audience and forge new business contacts. On top, three overall winners will receive a prize money of 10,000 euros each.

#### The ACHEMA Start-up Award is presented by DECHEMA Gesellschaft für Chemische Technik und Biotechnologie e.V., DECHEMA Ausstellungs-GmbH, Business Angels FrankfurtRheinMain e.V. and High-Tech Gründerfonds. The ACHEMA Start-up Prize is also supported by the German Chemical Society (GDCh), the Association of German Engineers (VDI), the German Chemical Industry Association (VCI) and the German Federation of Industrial Research Associations (AiF) as well as the Business Angels Network Germany and the Forum Start-up Chemie.



## START-UPS AT ACHEMA 2021

ACHEMA 2021 will include a first-class Start-up area at a prime location of the exhibition group "Research and Innovation" featuring

- \_\_\_\_ innovation pitches
- \_\_\_\_ an investor's lounge
- \_\_\_ matchmaking possibilities and last but not least
- \_\_\_\_ the casual "Start-up Night" which brings the networking possibilities to a new dimension.

The ACHEMA start-up area will not only be an exhibition and showcase area-it will also be a gathering place for pioneers, groundbreakers and super minds of tomorrow's process industries where they meet with investors, experts and decisionmakers up to today's C-suite.

The ACHEMA participants are well known for their high expertise and being sticklers for details. They will dive in deep with the start-ups, giving those young enterprises priceless opportunities to earn their trust and build strong relationships for projects and business to come.

# THE GLOBAL START-UP LANDSCAPE

The International Sustainable Chemistry Collaborative Centre (ISC3) is an independent, international institution promoting and developing sustainable chemistry solutions worldwide.

## MOBIUS, USA

has developed a family of naturally degradable and compostable polymers made from lignin,

a by product of the paper and biofuel industries, that offer a sustainable alternative to single-use and petroleum-based plastics.



#### ANDES BIOENERGY, ECUADOR

has developed a process to produce biochar from agribusiness biomass wastes which can improve

tropical soils as well as provide renewable thermal energy employing the P-SMART (Pyrolysis Small and Modular Auger Reactor).



Start-ups are an important cornerstone in ISC3's activities as they are seen as a unique source of knowledge and innovation that can contribute to a more sustainable future. ISC3 supports them via competitions and the Global Start-up Service, the world's first programme providing holistic support to sustainable chemistry innovators globally.

Since September 2019, the ISC3 also awards the title of "Start-up of the month". The list of featured start-up companies shows the tremendous creativity and innovation power of founders and entrepreneurs all over the world. •

#### LE QARA, PERU

uses biotech, engineering expertise and microorganisms to create high-quality vegan leather that is biodegradable and toxin-free.

A specific consortium of microorganisms which is fed with plants and fruit residues produces a leather-like biomaterial.



Illustration: agrus / Adobe Stock

#### **INDRESMAT, THE NETHERLANDS**

develops polyurethane resins that are versatile, durable, recyclable and sourced from renewable raw materials, mainly vegetable oils and lignin.

Currently, they are brought to market in sustainable building materials, such as frames for windows and doors and insulating foam coatings.



#### **INNOVERDA, FRANCE**

works together with chemical and pharmaceutical producers, testing if traditional processes can be improved by their electrochemical approach. Electrosynthesis can significantly reduce the

inputs of energy, toxic and corrosive substances, non-renewable raw materials, and high pressures and temperatures.





#### **BANYAN NATION, INDIA**

works with local waste collectors to produce near-virgin grade plastic granules that it sells to leading manufacturers in a variety of sectors. The business rests on two pillars: a data intelligence system that traces plastics recycling activities in major Indian cities and a proprietary

process to clean the collected plastic, customising it for the specific thermal and mechanical needs of brands on a large scale.





Ø\_ISC3.ORG

# BETTER SAFE SECURE THAN SORRY

Product and process security is one of the focal topics at ACHEMA 2021, as the Internet of Things calls for an intensified approach to secure the interaction between the physical and the virtual worlds.



# HASYOUR COMPANY ALREADY BEEN HACKED?

If not, you should expect the attack. According to IT experts, there are only these two states and all you can do is to prepare well.

his may seem like a gloomy attitude, but it is backed by impressive numbers. The latest World Economic Forum report on global risks lists cyberattacks and data fraud as two of the top five risks companies are most likely to face. While safety systems are well established and the number of accidents with personal injury is decreasing steadily, cyberattacks are becoming all the more prevalent – in the process industry, too. Lanxess, BASF, Siemens and Henkel are known to have been infected with Winnti malware in 2019, and even German safety and security specialist Pilz couldn't evade an attack

with ransomware. In this case, it was directed at office communication systems, but IoT devices are increasingly becoming part of operation and production and need special attention to keep processes and products secure. With every valve that has an IT interface and with every "intelligent" pump sending data into the cloud, IT and cyber security rise to the top of the list of things to be concerned about. In times of IoT, each supplier, each automation component and each person represents a potential risk. Therefore, the responsibility lies with every player along the supply chain. ACHEMA 2021 is now putting a spotlight on these challenges. Moreover, the Digital Hub in hall 12 welcomes key players in software and digitalisation to the ACHEMA family. You haven't seen them at the show before, but we are sure you wouldn't want to miss this valuable addition. Read more on that on page 18.

#### NO MAN IS AN ISLAND, NOR IS A COMPANY

Working with an air gap that physically disconnects a system from the internet is one way to keep assailants at bay. However, the global economy is interconnected and many businesses depend on complex supply chains. Business partners and suppliers need to trust each other as well as their cybersecurity practices. If you can't be sure that your supplier patches known system vulnerabilities with due diligence, a business friend can quickly become a "frenemy", threatening your own operations.

When trust is an issue, distributed ledger technologies such as the blockchain are often quoted as the solution. Managing data in a decentralised way is supposed to make them immune against falsification. Blockchain expert Prof Philipp Sandner and colleagues elaborate on page 12 on use cases in the chemical and pharmaceutical industries. Blockchain practitioner Dr Silvio Stephan presents a real-life application in the chemical industry on page 14 and claims that it has the power to change the whole process industry.

## **COST OF CYBERCRIME**

Average annual cost of cybercrime by country 2018 in million US\$



Source: www.accenture.com

## MAJORITY OF GERMAN COMPANIES ARE AFFECTED BY CYBERCRIME

Bitkom asked 1000+ companies: "What types of data theft, industrial espionage or sabotage has affected or is likely to have affected your company in the last two years?"



"A business friend that ignores cybersecurity practices can quickly become a 'frenemy'."

#### REMEMBER THE HUMAN FACTOR

Identifying, assessing and addressing the vulnerabilities of your business is the first step towards secure products and processes. Technical aspects, such as data backups and patching software vulnerabilities come to mind first. On page 16, you can look over the shoulder of Moritz Lottermann, specialist in penetration testing. "Contract hacker" by trade, he evaluates possibilities to break into his clients' systems, just as a malevolent hacker would do.

Technical considerations aside, human error is the one factor that the majority of hackers use to breach networks. Haven't we all received e-mails from the Nigerian connection, asking to pay money before you get the huge payoff (that never actually arrives)? That's social engineering, targeting greed – a basic human trait. Social engineering comes in many flavours, and it doesn't need to be digital. It can be as basic as the unknown person joining the group of smokers discussing business in front of the office building and walking away with useful information about the company.

**16 21** 

Analogue theft of

documents, records,

samples, machines,

components

Digital social

engineering

Source: www.bitkom.org

#### **ONLY AUTHENTIC DRUGS SAVE LIVES**

When it comes to pharmaceuticals, product security can become a matter of life and death quickly. Maintaining the cold chain is vital for drugs such as insulin. Drug counterfeiting is a growing problem around the globe, thus legislators took action. China was a frontrunner in implementing serialisation regulations. In the European Union, it has been a year now that every single box of prescription drugs needs to be clearly identifiable and bear a tamperevident label. The example of serialisation shows particularly clearly the importance of secure production processes in pharmaceutical technology. Previously, the drug packaging was protecting the contents and a brand carrier for the manufacturer, now it has developed into a data carrier and certificate of authenticity. •



### **GOOD TO KNOW**

**Security:** prevents malicious activities by people.

**Safety:** prevents accidents; people may or may not be involved, but in any case the action is not intentional.

**Cybersecurity:** the practice of protecting systems, networks, and programs from digital attacks.

**Malware:** software to cause damage to a computer or computer network including viruses, worms, Trojan horses, ransomware.

**Ransomware:** malicious software cybercriminals use to hold data hostage until a ransom is paid. If the demands are not met, the encrypted data remains unavailable or may be deleted.

**Denial of service (DoS):** flooding the targeted server with superfluous requests, causing an overload that prevents legitimate requests from being fulfilled.

**Phishing:** social engineering attack to obtain sensitive information such as usernames, passwords and credit card details by disguising oneself as a trustworthy entity in an electronic communication.

**Pentest:** short for penetration test: authorised simulated cyberattack on a computer system to evaluate the security of the system.

# NEW WAYS TO FINANCE THE PROCESS INDUSTRY

The blockchain is catching on in the process industry by way of the financial department. It contributes to drastically reduce the cash conversion cycle and enables the supplier to access liquidity earlier.

uyers of chemical products rely on the continuous availability of their raw materials. In order to guarantee constant availability and quality of supplies, a high focus is put on monitoring, automating and digitising entire supply chains through measurement technologies and sensors along the path. Therefore, shipments can now be controlled and executed as needed to ensure that the flow of goods meets the customer's requirements.

#### ACTIVATING ASSETS IN THE BALANCE

In addition to consumption-based provisioning through methods such as vendormanaged inventory (VMI), automated consumption-based financing is the next step to release capital tied up in the supply chain and thus reducing capital and transaction costs. In fact, in today's production economy, the terms of payment only cover parts of the time where the capital is tied up in current assets. In addition, there are production and transport times or consignment stocks. The time span between from leaving the producer's warehouse, to delivery and storage at the customer's warehouse, to reimbursement can therefore easily cover several months. By applying innovative approaches like factoring,

# **HOW DOES THE BLOCKCHAIN WORK?**



these unproductive periods can be shortened. This is only possible with considerable administrative efforts (or not at all), despite the potential financing volume of hundreds of billions of euros of global capital tied up in the supply chain. While buyers benefit from long payment periods and consignment agreements, sellers have to bear the costs in the form of financing current assets.

Issuing the invoice and the corresponding payment (or even financing from a partner institution) as soon as a product is ordered or consumed, e.g. from a consignment stock, would significantly increase the cash-to-cash cycle and reduce the pressure on the supplier. However, in most cases, insufficient data quality does not allow any action to be implemented in a fully automated way since a legal proof-of existence is only provided with the respective shipping notice being delivered. Often, orders display too small ticket sizes for banks to propose attractive financing solutions and have to be processed manually.

# INCREASING TRUST BY DISTRIBUTING LEDGERS

Innovative technologies, like blockchain and distributed ledger technology (DLT) in general, will play a major role in enabling autonomous payments in the industry. ►

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# "Autonomous payments will transform supply chains in the chemical industry."

PHILIPP SANDNER

# E-MONEY REVOLUTIONISES THE BLOCKCHAIN

The autonomous handling of supply chain finance processes is bound to have a profound impact on the process industry. Orbit Logistics GmbH and AZHOS AG are testing the concept together with well-known chemical companies.



\_\_\_\_ Filling level sensor signals trigger smart contracts on the blockchain

nstalling sensors on silos and tank facilities and linking them with blockchain technology makes it possible to process payments autonomously-in contrast to the traditional sequential supply chain processes. The sensor signals then trigger smart contracts: specific program codes on the blockchain that guarantee, for example, the execution of financial transactions, provided that predefined conditions are met. Thus the flow of goods and finances could be synchronised in the future.

#### REAL MONEY INSTEAD OF CRYPTO CURRENCY

The greatest challenge was to create system and legal compatibility. This was achieved by forgoing crypto currencies such as stable coins that are tied to stable assets. Instead, payments are made with E-money, meaning "real money", on the blockchain. This is an absolute innovation in industry and a worldwide precedent, which should make it possible to scale this use case quickly. This is a big step for the use of blockchain technology in an industrial environment, especially for the autonomous processing of payment transactions. There is practically no effort for the companies, since the transactions take place on the blockchain, but the bookings are made in the IBAN accounts by linking them to wallet addresses on the blockchain. An important advantage of this solution is the creation of programmable cash; in the case described it's "euro on ledger".

#### WITHDRAWAL OF GOODS TRIGGERS PAYMENT

The industrial sensors in the silos measure the fill levels and store the inventory data on the blockchain in an unchangeable, forgery-proof and thus audit-proof manner. "Proof of existence" is bindingly documented. Together with the electronic delivery note, "proof of delivery", it represents a sufficient and binding basis for the following autonomous payments. If the customer withdraws goods, the changed inventory triggers a transaction. The smart contract determines the amount of the transaction by calculating the value from quantities consumed and price. This type of autonomous settlement is also known as "pay per consumption" or "pay per use".

In the future, such applications with euro on ledger will be able to shorten payment cycles, improve cash flow, eliminate costly posting processes and release capital tied up in the supply chain in a sustainable way.

#### **DR SILVIO STEPHAN**

is CEO at Orbit Logistics AG, a leading international provider of inventory management solutions and supply chain automation.

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 $\mathcal{O}_{-}$  orbitlog.com



\_\_\_\_ Filling sensor installed on a silo.

SPOTLIGHT

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► Blockchain technology can increase trust, transparency and privacy of business processes by providing a shared, decentralised distributed ledger for information used in business processes by different players at the same time. A blockchain system can therefore be used to store data collected from Internet of Things (IoT) devices, like sensors or machines. It enables harmonised and standardised data standards between multiple parties.

#### CONSENSUS IS KEY IN THE BLOCKCHAIN

If data is collected on a blockchain, the data is also protected from manipulation as long as not every party involved consents. As soon as a blockchain is used in combination with inventory measuring sensors, the creation of a certain proof of existence for inventory is enabled, stating which amount of a good was stored at which point in time at a certain location. Information processed and stored immutably on a blockchain serves as a perfect basis for autonomous processes since further inventory checks are made redundant.

#### **PAYING CHEMICALS BY USE**

If applied on a consignment structure with a monthly inventory cycle, for example, sensors can be used to continuously measure the inventory levels in each silo and record this information on a blockchain set up between the supplier and the customer. Due to the data quality ensured by the blockchain, every inventory level measurement equals a proof of existence for the material. Therefore, every inventory movement is a proof of consumption by the customer or of a new delivery. Instead of paying the consumed inventory monthly, the information on the blockchain can directly trigger a corresponding payment process. Each time a consumption is measured and recorded on the blockchain, an invoice is created and the payment from the customer is validated. This process drastically reduces the cash-to-cash cycle and enables earlier access to liquidity for the supplier. Since most customers are not interested in shortened terms of payment, accordingly, a financing institution can be integrated providing instant liquidity in terms of supply chain financing for each consumption.

#### **TURNING SILOS INTO PROFIT CENTRES**

Besides the sole advantage of having access to cheap liquidity, the system allows each silo or warehouse system to act as a single profit centre from an accounting perspective. This adds transparency, enables activity-based costing approaches and makes the underlying assets accessible for institutional investors as well as securitisable tokenisation. Furthermore, when directly connected to the respective legacy systems, all manual steps regarding the ordering and invoicing process can be made obsolete. If set up properly, all the mentioned processes would autonomously run for months without any human interaction required.

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#### **PROF DR PHILIPP SANDNER**

is head of the Frankfurt School Blockchain Center (FSBC) at the Frankfurt School of Finance & Management and was ranked one of the "Top 30" economists by the Frankfurter Allgemeine Zeitung (FAZ) in 2018.



#### **JONAS GROSS**

is a project manager and research assistant at the Frankfurt School Blockchain Center (FSBC), specialising in cryptocurrencies and central bank digital currencies.



#### **TONY OEHM**

is COO of AZHOS AG, which provides supply chain finance and management solutions for the chemical and oil industry using blockchain technology.



# PENETRATION TESTS MAKE PRODUCTS SECURE

The buzzword Industry 4.0 embraces production facilities becoming increasingly digital and smart. As a consequence, companies are confronted with the issue of IT security due to the networked production. The effects of a hacker attack are particularly noticeable in the production process. In order to ensure product security, penetration tests against such systems or their components are becoming increasingly popular.

penetration test is a simulated hacker attack. The penetration tester uses the same techniques that a criminal hacker would use. Different experts are involved depending on the test object. If industrial devices with cloud connections are examined, experts for embedded systems, web applications and cloud infrastructure collaborate.

After the planning, in the preparation phase, the client creates the necessary framework conditions. If, for example, individual components of a production line are to be tested, the penetration tester needs these components in multiple versions.

While the pentest is conducted, a contact person should always be available for questions. It can happen that a device does not work correctly after an attack and then a close contact between pentester and client is beneficial in order to fix errors quickly.

#### PENTESTING IS FOR HARDWARE, TOO

When testing the hardware of an industrial device, first the accessible interfaces, such as network connections or proprietary plugs, are checked. Often the housing is opened as well to examine its contents, as the security of the memory devices is often neglected during development. If a cyber-criminal can procure identically construct-ed operating system memory, they can draw conclusions about the encryption, extract and manipulate the operating system memory of the device and thus compromise the entire device.

Embedded tests also focus on what are known as debug interfaces. These are required during hardware development and **BERCENT** of ransomware attacks are caused by phishing e-mails Source: Datto's ransomware report 2019

allow direct access to the system. Occasionally, these interfaces are not removed or disabled in the final production. If there is a back-end component for the device, it is recommended to test it, too.

Just as a hacker would do, a penetration tester is interested here, among other things, in the authentication and authorisation concepts as well as in the possibilities of escalating their privileges and reading out external customer data. At the end of every pentest, there is a report with detailed explanations about the vulnerabilities found. In order to be able to fix them, they should be described in a way that the customer can reproduce them independently. Of course, the company carrying out the test should be available for questions about weak points or their elimination.

#### **MORITZ LOTTERMANN**

has been conducting penetration tests at SySS GmbH for 2.5 years. As a member of the hardware focus team, he analyses products from the Internet of Things (IoT) environment.



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 SYSS.DE

> <u>It takes a holistic</u> approach to protect a company from cyberattacks.



# **FACTS AND FIGURES**

# **TOP 10 RISKS BY LIKELIHOOD**



## **AVERAGE ANNUAL COST OF CYBER-CRIME TYPE OF ATTACK 2018**

in USS







million Web-based attacks



million Denial of service



Source: www.accenture.com

**DEMAND FOR RANSOM IN 2018:** 



Median demand

us\$ 10,000 per incident

**Highest demand** 



Source: www.beazley.com

## **STATES WITH CYBER-CRIME LEGISLATION**

per region

Yes / No

Cyber-

attacks

Asset bubbles

in a major

economy

10

Europe Asia-Pacific Arab States Americas Africa 40 10 20 30

Source: ITU-D Telecommunication development sector

# **CYBERCRIME LEGIS-**LATION GLOBALLY





Max Buchner

is the mastermind

behind ACHEMA.

# **100 YEARS O**

One man – one idea – one trade show. Max Buchner was a chemist by trade and his ambition was "to bring chemists and engineers together for fruitful cooperation". Take a tour through 100 years of ACHEMA history from 1920 till today and see how Buchner's dream became a reality.



The humble beginnings: 75 companies cover 560 m<sup>2</sup> of exhibition space in 1920.



The first rover sends data from Mars in 1997 and a copy lands at an exhibition booth.



The newly developing field of biotechnology uses much the same apparatus as the chemical industry. Bioreactors with process control units have been a staple at ACHEMA since 1982.

Analytics are becoming increasingly mobile in 1976.

1976

JUMO Mobili



High tech meets cuteness: a MRT system for guinea pigs at ACHEMA 2006.



Interactive discussions, high-level speakers and a well-known congress have always been an inherent part of ACHEMA.

# FACHEMA





# APPLICATION ALWAYS ON THE MIND

Why go to a conference session when the exhibition is enticing you with all its sensual attractions? Because the ACHEMA congress is where innovation is born.

here do all the innovative technologies, the gleaming stainless steel devices and the new processes the exhibitors are providing equipment for originate from? From science and applied research! This is why the congress is and always has been an integral part of ACHEMA – as the cradle of innovation.

Just as exhibitors and buyers from all over the world meet in the exhibition halls, researchers, developers and users get together in the congress to discuss what's needed, what's possible and what will be the next big thing in the process industries. Application is always on the mind of speakers and audience – no wonder with the thriving exhibition next door. The close interlinking guarantees the practical relevance of the presentations that also pick up on everyday challenges encountered in industry, providing new solutions from the lab.

#### **GAMECHANGING TRENDS**

Based on the unique expertise and network of DECHEMA, the ACHEMA congress covers topics that are highly relevant to researchers and industry alike. Trends that have the potential to change the whole industry such as

- the boost of integrating renewable energy in chemical processes
- \_\_\_\_\_ the strive for a circular economy



### HIGHLIGHT SESSIONS: INDUSTRY VISIONARIES ON STAGE

Each day, a Highlight Session will be dedicated to topics that move and shake the industry. What do visionaries expect, and what is the answer of industrial players? Join the discussion on

- Hydrogen as a gamechanger within the process industries
- Recruiting cells for chemical production: novel biological production systems
- Closing the loop with chemical recycling: potentials and challenges
- Artificial intelligence: data for advanced processes and product development





### SUBMIT YOUR PAPER AND SHOWCASE YOUR EXPERTISE AT THE ACHEMA 2021 CONGRESS

#### Papers can be submitted to all of the following topics:

- Future production: modular, connected & smart
- Industrial intelligence & sensorbased process control
- Plant design & maintenance
- Pumps, compressors, valves & fittings: state of the art in fluid handling
- Innovative mixing & separation solutions
- Bioprocessing: bioreactors, process development & control
- \_\_\_ Pharma meets production

#### — Renewing the chemical & pharma supply chain

- Materials & material processing
- \_\_\_ Additive manufacturing
- Innovative product design in mechanical process engineering
- The digital lab: laboratory & analytical techniques
- Raw materials
- Water technologies
- Future energy use in process industries
- Product & process security
- \_\_\_ Safety first!

To accommodate the preferences of different stakeholder groups, the congress programme offers two distinct formats.

#### **Congress sessions**



Congress sessions cover applicationoriented research up to the threshold of market entry and showcase current trends in process technologies **PRAXISforums** 



PRAXISforums are meeting points for technology seekers and solution providers that focus on upcoming or existing solutions and are located close to the corresponding exhibition groups.

Submissions will be aligned according to their fit with either the congress or PRAXISforum profile.

classical Q&A to sessions where members of the audience are encouraged to get actively involved. True to the spirit of ACHEMA, scientists, renowned researchers and industry experts will be invited to take the stage as well as students, founders and innovative thinkers.

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Ø\_ACHEMA.DE/CONGRESS

- the ongoing digitalisation in research and production
- \_\_\_\_ the integration of lab and production by integrated process design

and many more are covered in highlight sessions, presentations and discussions. The overarching trends account for the breadth of the programme. But they are also broken down to explore in depth their impact on different disciplines and to discuss what different fields of research can contribute.

To enable a lively discussion and promote the forging of new contacts, the congress will consist of formats with different degrees of interactivity, from the

# THE ACHEMA DIGITAL HUB

Digitalisation has established itself as one of the top items on the process industry agenda and has become an ever-stronger topic in the ACHEMA community – high time to close the ranks with the digital ecosystem at ACHEMA 2021!

igitalisation and the ensuing digital transformation has staked its claim way beyond the traditional realms of IT departments and arrived at the core of the ACHEMA community, sometimes with brute force. Expectations to leverage efficiencies and create new opportunities keep rising in sync with the breadth and speed of technologies becoming available to the industry. Technology, of course, is necessary but not sufficient for long-term success: People development and transformational leadership are just as important.

Many exhibitors have begun to partner with the digital ecosystem, and digital players, on the other hand, sport some impressive industry-specific use cases by now. But: A lot of work remains to be done. The implementation in the process industry's delicate processes is all but easy, and many in our ACHEMA community are looking hard to find viable solutions that work and

"The ACHEMA Digital Hub will showcase digital technologies and applications for process industries."

ANDREAS KONERT



deliver what they promise. And, more importantly: fit well into the often brownfield context and integrate effortlessly with each other and legacy systems already in place.

High time to close the ranks, we thought, and initiated the ACHEMA Digital Hub.

#### THE DIGITAL HUB IDEA IN A NUTSHELL

The Digital Hub will be the central gathering place for digital experts and enthusiasts at ACHEMA 2021. It will be the platform for exhibitors from the digital ecosystem showcasing highly relevant technologies and use cases that do not fit into the ACHEMA exhibition group categories. It will serve as an exhibition and meeting space as well as a learning and networking hub. A central stage and smaller break-out areas will provide the latest expert insights and allow for fruitful discussions with leaders and experts alike.

As a hub, it will also provide comprehensive linkages to other digital showcases across ACHEMA. After all, the Digital Hub is just one piece of the puzzle.

Visitors will find a lot more digital solutions and use cases at the 3,700+ exhibitors or the ACHEMA Congress and PRAXISforums all across ACHEMA.

The Digital Hub concept was developed in close cooperation with leading protagonists from the digital ecosystem. We are currently crafting the agenda and recruiting exhibitors. Care to join? •

### FOCAL TOPICS HIGHLIGHT DIGITALISATION ACROSS ACHEMA

Our ACHEMA 2021 focal topics will highlight some of the most pressing issues:



PRODUCT AND PROCESS SECURITY

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Ø\_ACHEMA.DE/DIGITALHUB

# WAKE-UP CALL FOR RUSSIA'S PROCESS INDUSTRY

The Tatarstan Ecological Forum premieres 2–4 September 2020 in Kazan alongside the established Tatarstan Petrochemical Forum – and you can be part of it.

he times one could associate Russia's industry, particularly Russia's petrochemical sector, with all kinds of environmental wrongdoing and ecological ignorance are definitely over.

By now authorities and industry players alike have understood the necessity to provide appropriate framework conditions to safeguard a healthy environment and to minimise the ecological impact of industrial growth. This is the overriding motive to hold the first Tatarstan Ecological Forum in Kazan coming September. At the same time, this is also the motive for DECHEMA to support this initiative of the Ministry for Ecology and Natural Resources of Tatarstan, Russia's petrochemical hub.

Tatarstan is a semi-independent republic which stayed under the political administration of Russia after the disintegration of the Soviet Union. It is also the epicenter of the country's process industry. Thanks to abundant fossil resources, the Republic of Tatarstan gained economic self-determination but remained under Moscow's umbrella in terms of laws, currency or foreign politics.

As far as Russia's process industry is concerned, there is no way around Tatarstan. No other Russian region offers a similarly immediate access to fossil resources, together with well-established industrial sites, special economic zones and efficient logistics.

Hence the Ecological Forum being held this September is not only a clear vote for improving environmental standards – it is also a direct call to action for the country's petrochemical sector.

#### Topics of particular focus are

- \_\_ clean water
- \_\_\_\_ industrial water cycles
- \_\_\_\_ industrial safety
- \_\_\_\_ energy efficiency



**3.9** m

QUICK FACTS TATARSTAN

Total population (2.4 m of working age)

**30** bn euros

**50%** of all Russian citizens live within 1,000 km of Kazan

**1st** in the national ranking of business climates in Russia

#### \_\_\_\_ circular economy

\_\_\_\_ sustainable economic development

The forum will be a meeting point for experts and decision makers from various sectors of the Russian industry, with explicit focus on the petrochemical sector. So the event could very well be groundbreaking in a market which only recently has accepted the ecological challenge. Sure enough, some kind of pioneering approach will be needed here ... but it is obvious this implies the chance to leave a footprint in less contested territory with vast development potential.

As official co-organisers, DECHEMA will contribute to the event by organising a conference session of its own.

### BE PART OF KAZAN ECOFORUM AND PRESENT YOUR KNOW-HOW

Submit a paper for any of the forum topics by sending a brief abstract via e-mail. Please note that speaking slots are limited and will be assigned on a first-come, first-served basis.

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#### PORTRAIT

# WHAT'S YOUR JOB, MRS HOLTHAUS?

Every employee of DECHEMA Exhibitions knows the question "what do you actually do when there is no trade show?" Ulrike Holthaus, Technical Director of ACHEMA, answers.



have been the technical manager since 1995; before that I allocated stands, and before that I was involved in the catalogue production. My current job is the most fun of all.

We are not only active in Frankfurt, but also in China. For us, therefore, ACHEMA is followed by AchemAsia, which takes place the following year. While AchemAsia is still running, we are already preparing the conditions of participation and the technical guidelines for the next ACHEMA. From afar, those documents always look the same, but it is not just a matter of copy and paste. We have to work through them diligently and check whether any legal regulations have changed in the last three years. Now, the year before ACHEMA, my team and I are busy setting up the ordering portal and selecting service providers, such as stand construction companies. Exhibitors who don't want to take care of stand construction themselves can book it with us. The service provider then builds the stand and when the exhibitor arrives at the venue, the final stand is already there.

#### THE TIDAL WAVE HITS IN MARCH

There is always a certain day when ACHEMA really takes off, but you don't know in advance which one it will be. Usually it is sometime in March of the ACHEMA year, and it hits you like a tidal wave. A wave of calls, of e-mails, of emotions, of everything. Orders come flooding in and heaps of stand plans need to be approved. At that point, ACHEMA is omnipresent, it feels like being immersed in an ACHEMA swimming pool. It's chop-chop from then on. You have to be able to make decisions quickly, otherwise you can't do this job. It's all about not going crazy. During this time in particular, I often think I have the greatest job in the world.

We take over the exhibition grounds twelve days before ACHEMA opens. First thing, we check all the halls and find out about any existing damage. Just as you do when you take over an apartment as a private person: Are the walls stained, are there holes in the floor, or are glass doors broken? Then we discuss with the venue owner, Messe Frankfurt, what needs to be repaired before the show.

Exhibitors have seven days to set up their booths. Two days before the doors open, the fairgrounds are packed, there's a hustle and bustle of unpacking boxes, construction work and decorating. On the last day, the biggest task is to have thousands of boxes removed from the halls on time so that the aisle carpet fitting can start. Many people's nerves are shattered by that time. Conflicts can sometimes arise between stand neighbors when someone feels treated unfairly or one has actually built beyond the edge of the other's stand. It is my job to settle these disputes, and I know what exhibitors say about me: "When she comes, there's trouble ahead." But I can live with that.

#### A SIGH OF RELIEF ON MONDAY NIGHT

When ACHEMA starts, I am also responsible for safety. At the daily morning briefing with Messe Frankfurt, the fire brigade, the police and technical services, we discuss safety-relevant issues of all kinds, even the weather. If it is hot and humid, the air conditioning systems are running on maximum, and in heavy rain, supply ducts have even been under water.

#### On the evening of ACHEMA Monday, I can take a breath for the first time. When "Meet your friends" has begun, I know that the set-up went well as did the opening ceremony, and it leaves me with a strong energy boost – so far I have danced at every exhibitor evening.

During ACHEMA, my daily business is to take care of some events taking place in addition to the trade show and the congress programme. The jobs range from checking whether a flower arrangement is in the right place to conjuring up 50 more chairs, and I am always on my feet. On an average day at the show, I clock over 20,000 steps on my pedometer. Shoes that are as comfortable as sneakers but don't look like them are essential for me. I admire women walking around the fairgrounds in high heels.

#### PLANNING DEPARTURES ON THURSDAY

ACHEMA Thursday is dominated by inquiries about dismantling on Friday. The usual scenario is: "My train is running, my plane is flying and I just want to get off the fairgrounds as quickly as possible, how can I manage that?" Friday is all about keeping the exhibitors calm and ending ACHEMA in a civilised manner. When the aisles carpets are going to be removed, it is important that there are no crates standing around obstructing the workers. As soon as the carpets have been picked up, cars and vans are allowed on the site for disman-

# "When the ACHEMA gets going I often think 'I have the best job in the world'."

**ULRIKE HOLTHAUS** 

tling. I always watch the convoy of vehicles entering the fairgrounds. On the one hand, because it is a real spectacle how this infinitely long queue of vehicles rolls in, on the other hand, because I need to know whether everything is working smoothly.

On Friday night, I leave around 10 o'clock. At two o'clock next morning, "empties night" begins, and an army of forklifts swarms out to deliver the stored packing crates from the storage rooms to the stands.

Dismantling lasts until Wednesday after the fair. On Wednesday afternoon, the construction supervisors and I will check whether everything has gone from the halls and no stand was forgotten. When we leave the fairgrounds and everything has gone well in terms of safety without any serious accidents, ACHEMA is over for me and I can breathe a sigh of relief.

I go on holiday when invoices have been settled with the service providers and the venue owner, usually four to six weeks after the event. My favourite place is Southern Crete, where there are no stimuli at all and the most pressing task is to count how many ants there are scuttling under the breakfast table.

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# GETTING RID OF GREENHOUSE GASES

The German chemical industry is – in terms of revenue – the fourth largest in the world and a backbone of the German economy. Accordingly, national and international attention was enormous when DECHEMA published a study in October commissioned by the VCI (Association of the German Chemical Industry) stating that the German chemical industry could become GHG-neutral by 2050.



# Saving CO2: 51.1 mt

#### SYNTHETIC NAPHTHA FROM CO2 AND HYDROGEN FROM ELECTROLYSIS

Hydrogen and CO<sub>2</sub> can be converted into synthesis gas. The synthesis gas in turn can be processed, e.g. by the well-known Fischer-Tropsch synthesis, resulting in long-chain alkanes, among them so-called synthetic naphtha that can be fed into the cracker, producing olefins and aromatics.

#### Introduction: 2040

he chemical industry has already made tremendous progress over the last decades and at least partially decoupled growth and GHG emissions. But "GHG-neutral"? That seems ambitious, to say the least.

The greenhouse-gas-neutral pathway is the most interesting scenario– of course, as it is the most ambitious, but also due to the profound technological analysis it is based on. Based on their current Techno-

## Saving CO2: 7.9 m t/a

#### AMMONIA FROM HYDROGEN BY ELECTROLYSIS

In this process, the hydrogen derived from steam reforming of natural gas is replaced with hydrogen from water electrolysis. This requires the provision of pure nitrogen and according investments in air separation components. TRL 9 or industrial applicability is expected to be reached in 2031. However, production capacities of these plants are expected to be significantly lower than those of today's plants due to size restrictions of the electrolysis plants. CO<sub>2</sub> savings depend on the emission factor of grid electricity. For Germany, introduction of the technology in 2040 is expected for the greenhouse-gas neutral pathway.

#### Introduction: 2040

# Saving CO2: 2.23 m F

## DROGEN BY ELECTROLYSIS AND $CO_2$

This technology is already at a demo stage. CO<sub>2</sub> can be supplied from industrial processes or biomass – in this case, greenhouse gas emission are fully dependent on the specific emissions of the electricity. Investment costs are high, with the electrolysis plant accounting for about 80 %.

Introduction: 2038

# 5aving CO2: 2.18 m

#### METHANOL FROM METHANE PYROLYSIS

Similar to ammonia, hydrogen for methanol synthesis can also be produced by methane pyrolysis. Emissions of this process are even today lower than in conventional processes, while investment is about 65 % higher.

Introduction: 2040

### Saving CO2: 7.75 m F S AMMONIA FROM METHANE PYROLYSIS

Hydrogen in this process comes from the pyrolysis of methane. The required investment is similar to that for ammonium from hydrogen by electrolysis, electricity demand is lower, but methane – fossil or preferably biobased – is required, resulting in higher economic hurdles.

#### Introduction: 2045

2045

logical Readiness Level ("TRL", a TRL=9 meaning ready for industrial implementation on a large scale), different technologies have been assessed for their time to market, their effect on  $CO_2$  emissions and their cost competitiveness. From this, a timeline for their introduction has been developed.

The processes considered are those for the production of the highest-volume chemicals chlorine, ammonia, urea, methanol, ethylene, propylene and butadiene as well as BTX. They are the basis for most of the overall product portfolio of the chemical industry, and their production today accounts for 75% of greenhouse gas emissions.

While some production processes such as the current chlorine-alkaline process are not be expected to be replaced by disruptive technologies, other chemical products may in the future rely on a completely new feedstock base, in which biomass, hydrogen and CO<sub>2</sub> via carbon capture and utilisation (CCU) play a dominant role.

2050

2040

# WHICH WAY TO GO?

The study "Roadmap Chemie 2050" outlines three different pathways:

#### **REFERENCE PATHWAY**

Chemical companies continue to use today's technologies and invest at the current level into maintenance and efficiency of plants. Mechanical recycling of plastics becomes more important.

Due to the increasing share of renewable electricity and efficiency gains within the existing chemical processes, greenhouse gas emissions from the chemical industry decrease by 27% by 2050, with the lion's share being realised by 2030.

#### **TECHNOLOGICAL PATHWAY**

The chemical industry introduces new production technologies for basic chemicals such as ammonia or methanol, but investment is limited by economic and technical restrictions: The maximum available electricity for chemical production is estimated to be 225 TWh, around the current renewable electricity generation in Germany, and the investment budget is capped at 1.5 billion euros per year. New technologies are introduced when they are competitive. Compared to the reference pathway, greenhouse gas emissions will decrease significantly, even after 2030 with a total reduction of 61% by 2050.

#### **GREENHOUSE-GAS-NEUTRAL PATHWAY**

This path assumes that neither the available (renewable) electricity nor investment budgets are limited. Any novel technology that reduces greenhouse gas emission is introduced as soon as it is available without concern for competitiveness of the technology. Technological developments are hastened, e.g. by increased public funding. Within these assumptions, the chemical industry will lower its greenhouse gas emissions by almost 100 % by 2050.

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ACHEMA.DE/MAGAZINE

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#### INTERVIEW

# Understanding and avoiding corrosion

While you are reading this article, around 1,400 kilograms of steel are crumbling away worldwide due to corrosion. Quietly and irreversibly.

Nly a few corrosion problems have a media impact as intense as a bridge collapsing, such as Ponte Morandi Bridge in Genoa, Italy, in 2018. However, every metal structure is constantly exposed to the effects of salts, acids, heat and microbes which over time corrupt its stability. The Corrosion Center at the DECHEMA research institute offers expert advice and services for corrosion-related topics.

Four questions for Dr Maren Lepple, the DECHEMA Corrosion Center's coordinator.

# Why should I turn to you with my corrosion problem?

\_\_\_\_ DR MAREN LEPPLE: We cover the whole range from basic research to industrial application in our corrosion work and are embedded within the DECHEMA Research Institute. Thus, we have a wider view than many other laboratories and our interpretation goes a lot deeper. We generally take a holistic approach, meaning that our results come with an interpretation,

#### FACTS AND FIGURES

250+ industry projects completed within the last 5 years

**30**+ experts develop innovative solutions for every industry

50+ years of experience in corrosion research



too. Furthermore, we are known for keeping red tape to a minimum and can therefore tend to your issue very quickly. Confidentiality statements and intellectual property agreements are treated with due diligence, of course.

#### Which industries are you addressing?

Generally, we are the right contact for everyone working with metallic materials. Historically, many of our customers are from the chemical industry and the plant engineering sector. However, we have done lots of projects for companies in the automotive and aviation industries, too.

#### Which services do you offer?

We cover the entire lifecycle of materials, from preventive measures to the analysis of corrosion damage. If you are looking for a corrosion-resistant material for a special application or developing a corrosion protection strategy, our experts are happy to consult. I wish mechanical engineers and plant manufacturers would contact us already in the design stage, which often is mainly based on material's mechanical properties. A lot of corrosion damage could be avoided by preventive testing and protection concepts. Advanced alloy selection, nanoparticles, ceramic thermal insulation, anodising processes – there is a solution for every metallic material.

If the damage has already occurred, we offer a wide range of tests for failure analysis, taking the experience from different industries into account. Our partners benefit from an experience of more than 50 years in corrosion research, state-of-theart equipment and the latest testing methods. Our experienced metallographs know how to uncover evidence from the microstructural analysis, microscopy and spectroscopy that can often solve a damage case.

#### What is the Corrosion Center's manpower?

\_\_\_\_\_ The DECHEMA Corrosion Center comprises around 30 experts in materials science and corrosion. They work closely with electrochemists, technical chemists and microbiologists at the DECHEMA Research Institute. This combination is pretty special and makes for a lot of synergies. It also makes us globally unique •

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# PULL YOURSELF TOGETHER, RABBIT HEART!

Distributed ledger technologies are mature enough to be applied in various industries. The chemical industry, however, is shying away despite plenty of use cases. Does the managers' age play a role in this?

nce upon a time, there was a rabbit who found a field of beautiful carrots. They were not quite the shade of orange that he was familiar with, but much more intensely coloured, glowing even. The rabbit was the patriarch of a large rabbit family, his whiskers greying with age. He sniffed the carrots, they smelled fine, yet he couldn't bring himself to take a bite. "Don't touch the carrots" he advised his rabbit offspring "something may be wrong with them." "Maybe – and maybe not," answered a particularly cheeky junior rabbit, "maybe they are even better than our usual carrots? Our neighbours the field hamsters have been eating them for quite some time, and they seem fine. They even have had particularly shiny coats ever since." That said, he dug heartily into the roots; they tasted delicious and were easily

digestible. The carrots turned out to be particularly rich in beta-carotene, hence the funky glowing orange and they were also richer in other nutrients. The new-fangled carrots made the junior rabbit grow large and strong; larger and stronger even than the rabbit patriarch had ever

been and the adventurous youngster lived happily ever after.

That's about what is currently happening in the process industries, with distributed ledger technologies (DLT) being the funky orange carrot. They may look unfamiliar, but other industries – think fintech and food supply – have been applying them successfully, and they wouldn't do so if it were to their financial disadvantage.



# "Don't touch the carrots, something may be wrong with them."

#### FEAR OF CHANGE

The chemical industry, however, is herding its companies wrinkling its nose in mistrust at the unknown like grey-whiskered rabbit patriarchs. Yet the "we have always done it this way" attitude no longer applies in this fast-moving world. To be successful today, you have to be constantly proactive, not reactive and take a mouthful of the unknown every now and then. Unfortunately, the term "bitcoin" is tattooed all over the DLT carrot. Too many reports about the energy-intensive mining process, the slow performance and the fluctuating price of the cryptocurrency make the glow too funky for many. It takes the adventurous type to try something new; whether it's a characteristic of youth to be venturesome is open for discussion. Industry insiders claim it is and point in the direction of fintech for proof: plenty of junior rabbits staffing the C-suite, eager to sample the next superfood carrot. "Fail fast, and if you fail, at least you have a good story for the next f\*ck-up night" is their philosophy.

The adventurous junior rabbit in the fairytale lived happily ever after. The fate of the fearful patriarch is unknown; he may still be nibbling stale roots and wondering where everybody else has gone.

# MEET THE COMMUNITY

Whether you are looking for a "deep dive" in your very specific area of expertise or would like to join in a cross-disciplinary discussion of overarching challenges, DECHEMA's event calendar offers meeting points for everybody.

- From workshops with 50 to international conferences with 3000+ participants
- Expert meetings in all fields of chemical engineering, technical chemistry and biotechnology
- \_\_\_ Transdisciplinary exchange on DECHEMA's focal topics





Pharmaceuticals



Medical Technology

**Bioeconomy** 



Chemistry





Water Management



All dates and information:



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