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Catalysts play a crucial role in dealing with the big changes in oil and gas feedstocks

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The market for chemicals and pharmaceuticals in Brazil, the host country of the FIFA World Cup

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Pfizer abandoned its month-long battle to take over AstraZeneca on May 26 as the deadline to make a final offer under British law elapsed.

Ineos and Solvay can pursue their asset merger to create Europe's largest PVC producer as the European Commission accepted the jv partners' divestment proposals.

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Companies:
Evonik might look for acquisitions worth over €1 billion. While soft-pedaling capital expenditure, CEO Klaus Engel did not rule out larger takeovers using equity financing.

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Production:
ExxonMobil has received final approval from the US Environmental Protection Agency to build its 1.5 Mt/y ethane cracker in Baytown.

BASF plans to build a world-scale methane-to-propylene complex on the US Gulf Coast to take advantage of low-cost, shale gas-derived ethane feedstock. Reports said the cost could exceed €1 billion.

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The Steep Climb Back to Profit

New Lanxess CEO Matthias Zachert Prepares the First Steps

Business Strategy — If Matthias Zachert mounted the steep steps to the new Lanxess headquarters on the Rhine River in Cologne, when returning to the German chemical producer as CEO on April I, he may have mused that the climb could be symbolic of the challenges he soon would be facing.

When the now 46-year-old manager stepped down as CFO in 2011 to take the same position at Merck KGaA, the company whose financial affairs he had guided since its 2004 spinoff from Bayer was still "living at home" — headquartered at its former parent's Leverkusen site. Axel Heitmann was still CEO and the share price was still rising.

Just three years later, the situation had radically changed. After several years of upward momentum — interrupted by an earnings slump of "historic proportions" in the 2008-2009 economic crisis — Lanxess, a company with more than €8 billion in sales and assets in rubber, plastics, fine chemicals and intermediates, had slipped into the red.

The share price was rapidly losing ground. Heitmann, reportedly at odds with the supervisory board about how to turn the rudder around, was "out of office" — permanently — and Zachert had been asked to take over the helm.

What had led to the dramatic development, whose public airing was unusual for a German chemical producer?

Without explicitly pointing a finger at his predecessor, the new CEO — who as finance chief still held the purse strings when some of the now controversial investment decisions were made — has hinted that over the past several years too much money was spent on too many of the wrong things. Or at least at the wrong point in the cycle.

Rising Capital Spending

Perhaps in an effort to shed the company's unflattering image as "Bayer's bargain basement" or simply lulled by the siren song of the stock market — Lanxess' papers were elevated to the DAX 30 blue-chip index in 2012 — observers say its management clearly overheard or chose to ignore warning signs that market conditions were deteriorating.

Worldwide rubber output was already swelling as Lanxess, with leading positions in such high performance specialties as EPDM, S-SBR, Nd-PBR and butyl rubber, announced several new projects. Low-cost competitors were entering the market. In Europe especially, the motor of growth in the automotive industry, on which the company depends for around 40% of its overall sales – was beginning to sputter.

As Lanxess' historical charts reveal, capital spending budgets rose sharply from €275 million in 2009 to just under €700 million in 2012 before tapering off to around €625 million in 2013 and 2014.

In March 2013, reporting on 2012, Heitmann declared the year just ended "the best in our growth story so far. Our business model proved itself once again." Not quite three months later, presenting figures for Q1 2013, he blamed the "weak start" on "a poor business climate worldwide."

By half-year reporting time in August, the then-CEO conceded that "customers were destocking," only to confirm a month later plans for a new €235 million, 160,000 t/y EPDM rubber plant at Changzhou, China. Lanxess' biggest-ever investment in the People's Republic is set for start-up in 2015, as is its 140,000 facility for Nd-PBR rubber — billed as the world's largest — in Singapore.

With Q3 net earnings down 88% year-on-year and the writing on the wall, in September 2013 Heitmann was obliged to announce plans for a new efficiency scheme, one of several in the company's short history. The Advance program, expected to return annual savings of €100 million from 2015, could lead to the loss of 1,000 jobs by year's end.

Impacted by impairment charges of €257 million in the Performance Polymers segment, which along with engineering plastics PA and PBT includes elastomers, and Performance Chemicals with the rubber chemicals unit, Lanxess' full-year balance sheet for 2013 showed a net loss, of €159 million, for the first time since 2005.

Let's Lanxess Again

At his first press conference as CEO in May 2014, Zachert highlighted some of his plans for a return to growth. Under the heading "Let's Lanxess Again," the newest restructuring scheme, steered by Boston Consulting Group, at least has a verbal new twist.

To ease the financial burden of restructuring and replenish its diminished cash flow, the company a day earlier announced it had quietly increased equity. With subscription rights of current shareholders excluded, 8.3 million shares, equal to 10% of equity and priced at €52 each, were placed with institutional investors in an accelerated bookbuilding process. The flotation netted €430 million.

In Cologne, Zachert explained to journalists that Lanxess' portfolio was imbalanced, in particular too dependent on the automotive sector. In view of the increasingly competitive landscape and its high level of indebtedness, the company must become "significantly more competitive and profitable."

The heavy emphasis on rubber that existed when Lanxess was created increased further with the substantial investment of recent years, he noted. Of the €3.4 billion capital spending for 2009-2013, Performance Polymers received more than 60%, compared with 20% for Performance Chemicals and only 15% for Advanced Intermediates.

Zachert said overhead costs have also increased substantially since 2009 and are now back at the level of 2005, before the fledgling company's first restructuring effort began. R&D costs have risen 110% since 2007, and the debt-to-EBITDA ratio is too high.

> *Lanxess will emerge from the realignment stronger than before.*

Turning Heitmann's remark about the successful business model on its ear, his successor suggested that to deal with heightened competition, higher energy costs and increasing complex customer relationships, a new model could be needed, a reevaluation of Lanxess' entire strategy required,

While optimizing administrative structures and streamlining decision-making, Zachert said he wants to improve customer and market orientation in the business units. Toward this goal, management will analyze the profitability of production sites and consider mothballing or even permanently shuttering plants.

Adapting to the Competitive Environment

"We are currently facing major challenges — especially as the competitive environment for our business with synthetic rubber has changed. And this is clearly reflected in our results for fiscal 2013," Zachert said at this year's Annual Meeting of Stockholders a couple of weeks ago.

To make its rubber activities more competitive and balance the portfolio, Lanxess will seek partnerships with other producers, customers or raw materials suppliers for businesses that have lost some of their bounce.

In the herculean effort to restore profitability, Zachert will need to perform some fancy footwork, but financial analysts and shareholders and employees alike seem convinced that the avid runner, physically not a tall man, will be able to fill the tall order. On the news of his return to his former employer, Lanxess shares' rose 9%, while Merck's fell 11%. In reaction to the successful equity increase, shares also nudged higher.

Most observers believe the financial markets will give Zachert — who is credited with excellent communications skills — a longer breathing spell than many new CEOs. Analysts have already applauded the partnership plan, with one speculating that — depending on the outcome — divestment of a majority stake in rubber assets could generate up to €1.7 billion.

While job cuts in the 17,000-member workforce appear a foregone conclusion as the scheme progresses, at a recent meeting with their new top boss in Leverkusen, German staff at least seemed to feel assured their jobs were safe — especially as most of Lanxess' rubber production is based outside the country.

To the stockholders, Zachert said: "I would like to already prepare you today for the fact that the next two to three years won't be easy. But I am sure that Lanxess as a company will emerge from the realignment stronger than before."

Outlook for 2014 Somewhat Brighter

Even if Zachert has warned that it could take two or three years for the company to twist again like it did just that many years ago, his forecast for full year 2014 appeared to signal no especially unpleasant surprises in the short term.

With sales down 2.5% to €2 billion in Q1, net profit was flat at €25 million. While Performance Polymers shed nearly 7% and Advanced Intermediates just over 3%, revenue of Performance Chemicals rose nearly 6%. The 10% rise in EBITDA pre-exceptionals is credited to "positive effects" in all segments, a lower cost base resulting from the Advance scheme and the absence of one-off charges.

For the second quarter of 2014 the company's EBITDA pre-exceptionals is expected to come in at €220-240 million, and settle in the range of €770-830 million for the full year 2014, up from €735 million a year earlier.

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New Valeant Bid Values Allergan at $49.44 Billion

As expected, Canadian drugmaker Valeant Pharmaceuticals International raised the cash component of its offer for Botox manufacturer Allergan on May 28. Its new offer values the US firm at $49.44 billion.

The beefed-up bid includes a cash component of $58.30 per Allergan share, $10 more than Valeant's previous offer of $48.30. The stock component remains the same at 0.83 of a Valeant share for each Allergan share.

Altogether, Valeant's new offer values Allergan at $166.16 per share, based on the May 27 closing price. This was 8.6% more than the initial bid of $153 per share, or $47 billion, made on April 22 by Valeant and activist investor Bill Ackman.

Allergan spurned the first bid, saying the Canadian company had overstated the possible savings from the deal. Valeant's latest offer is less than the $180-$200 per share investors were said to be looking for.

The new approach also includes a contingent value right of up to $25 per share related to the sales of Darpin, Allergan's experimental eye drug that is seen as a potential competitor to Bayer's Eylea, marketed in the US by Regeneron. (dw) ■

Pfizer Abandons £69 Billion AstraZeneca Takeover

In a widely expected move, Pfizer abandoned its month-long battle to take over AstraZeneca on May 26 as the deadline to make a final offer under British law approached.

CEO Ian Read said Pfizer continued to believe its final proposal to buy its smaller British rival for £69 billion ($118 billion), or £55 per share, was "compelling" and represented its full value. However, following the AstraZeneca board's rejection of the higher price, it had decided against another bid.

The US drugmaker's pullback ended a takeover attempt that would have been the pharmaceutical industry's biggest ever. It sparked political concerns on both

Ian Read
CEO, Pfizer

sides of Atlantic over jobs and corporate tax maneuvers.

UK rules now require a cooling-off period. This means AstraZeneca could approach Pfizer at the earliest after three months to reopen talks, and Pfizer could take another run in six months' time, whether or not it is invited back.

AstraZeneca Chairman Leif Johansson welcomed Pfizer's decision to walk away, which he said would allow the British drugmaker to focus on its growth potential as an independent player.

While mum on the outcome, the UK government – fearing the country could lose R&D clout – had sought assurances from Pfizer that it would preserve British jobs in research and production.

Major investors were at odds as to whether Pfizer's move was a wise one. Schroder Investment Management, AstraZeneca 12th-biggest shareholder with 2%, urged the company to restart talks. It was backed by the UK arm of Fidelity Worldwide Investment, holder of the 18th largest stake. Others, such as Dominic Rossi, London-based Fidelity's global chief investment officer for equities, argued that the deal was motivated purely by Pfizer's desire to cut taxes.

Had the merger had gone through, Pfizer could have relocated headquarters to the UK to escape a higher American corporate tax rate and free its overseas earnings from any US claims, a tactic known as an inversion.

A successful deal would have restored Pfizer as the world's largest drugmaker by sales, a position it relinquished to Swiss-based Novartis after its top-selling cholesterol drug, Lipitor, began facing generic competition, and diminished revenue, in 2011. (dw) ■

Air Liquide Acquires UK-based STG

French industrial gases producer Air Liquide has acquired UK-based Scientific and Technical Gases (STG), a global supplier of calibration and specialty gases and equipment.

Acquiring STG will enable Air Liquide to strengthen its position in the global calibration and specialty gases market, boosting its production and distribution capabilities worldwide, the company said. Its US arm, Calgaz claims to be global leader in calibration gas mixtures and equipment.

The UK company owns and operates two production facilities in the UK and suppllies customers worldwide through distribution centers in the US, Brazil, Australia, Singapore, Dubai and Shanghai. (dw) ■

Merck KGaA Prepares to Delist AZ Electronic Materials

With 97% of all shares in AZ Electronic Materials in hand, Germany's Merck KGaA has moved closer to its goal of delisting the company. The German chemicals and pharmaceuticals producer finally closed the €2 billion acquisition on May 9 after receiving the green light from Chinese antitrust authorities. (dw) ■

Westlake to Acquire German PVC Producer Vinnolit

Private equity investor Advent International has agreed to sell German PVC producer Vinnolit to Houston, Texas-based US petrochemical producer Westlake for €490 million ($668 million).

The US company, which will finance the acquisition with existing cash and credit facilities, expects the deal to close in the third quarter of 2014. With the buy, Westlake will move into sixth position in the PVC market worldwide.

A joint venture between the now-defunct chemical giant Hoechst and its then-subsidiary Wacker Chemie from 1993, Vinnolit was acquired by Advent in 2000. Shortly after buying the PVC jb Advent also took over Wacker's upstream VCM and caustic soda businesses, keeping operations back-integrated.

Several attempts by Advent to exit the PVC business, in part through a merger with other players, failed. Nevertheless, Vinnolit was able to invest in its production facilities as well as R&D while also making acquisitions during the unusually long 15 years in the hands of private equity.

Under Advent's ownership, German company in 2006 became one of the first to convert its chlor-alkali-electrolysis plants to an environmentally friendly and energy saving membrane process. Over the years, it also invested some €1 billion in the modernization and expansion of its European asset base.

Acquisition of the paste PVC business from Ineos Chlor Vinyls in 2007, following Ineos' takeover of the PVC business of Norsk Hydro, significantly increased Vinnolit's production capacity and cemented the German company's position as Europe's leading producer of paste PVC.

World's sixth largest PVC producer

With total sales of €917 million ($1.2 billion) in 2013 and PVC output capability nearing 800,000 t/y, Vinnolit operates six state-of-the-art production platforms in Europe, including five in Germany and one in the UK. Its capacity for feedstock VCM totals 665,000 t/y, and it also can produce 475,000 t/y of membrane grade caustic soda.

Westlake, with production facilities in the US and China, has PVC capacity of around 1m t/y. With sales of $ 3.76 billion in 2013, its assets are currently olefin-heavy, with a split against PVC of around two-thirds to one-third. Following the Vinnolit acquisition, the mix with be about half and half.

Westlake's new German arm will become Europe's largest player following the planned merger of the region's two market leaders Ineos and Solvay, with total capacity of 2.3 million t/y.

In future, Ineos-Solvay will be world's second largest PVC producer, behind Japan's Shin-Etsu, with Westlake-Vinnolit ranking six behind the two leaders, Formosa, LG and Chem China. (dw) ■

European Commission OKs Ineos / Solvay PVC Merger

Following an in-depth review, the European Commission accepted divestment proposals put forward in March by would-be PVC joint venture partners Ineos and Solvay and approved the asset merger that will create Europe's largest PVC producer by far.

As the two companies already are Europe's market leaders, the Commission had expressed concern about the impact the creation of such a large and powerful player would have on competition in the sector.

In their successful attempt to accelerate the approval procedure, Ineos and Solvay in March proposed to sell their suspension PVC plants at Beek, the Netherlands, Mazingarbe, France, and Wilhelmshaven, Germany, in addition to chlorine and ethylene dichloride (EDC) assets in Tessenderlo, Belgium, and Runcorn, UK.

Initially, they had proposed to divest only Ineos' two plants in Germany, at Wilhelmshaven and Schkopau. The latter facility is now outside the disposal package. Together the PVC production facilities have now pu up for grabs have capacity for an estimated 770,000 t/y – about a quarter of total output.

Without the divestments, the Brussels competition authority said the 50:50 joint venture would be in a position to raise prices in the northwest European S-PVC market and for sodium hypochlorite (bleach) in the Benelux. The two players together control 60% of the Benelux bleach market. Their only important competitor would be AkzoNobel of the Netherlands. (dw)

Ineos, Doeflex Plan Compounding JV

Ineos is moving quickly to expand its position as Europe's leading PVC producer. The Swiss-based group's subsidiary Ineos Compounds has announced plans to merge with UK independent compounder Doeflex Compounding into an integrated company.

The deal is subject to the EU's final approval of Ineos' planned 50:50 PVC production joint venture with Solvay, which recently was greenlighted by EU competition authorities and is scheduled to close in this year's fourth quarter.

Doeflex, whose activities are concentrated at Swindon, UK, has a portfolio of nearly 10,000 different compounds in both rigid and flexible PVC.

Ineos' PVC compounding business has operations in the UK, Switzerland and Sweden, with an estimated 100,000 t/y of capacity. It supplies special formulations of both rigid and flexible PVC compounds to the European the construction and medical supplies sectors.

The two companies said the goal of the merger is to be "better positioned to meet the needs of European customers in the rapidly changing markets and highly challenging economic environment." (dw)

Symrise Raises Equity for Diana Buy

German flavors and fragrances manufacturer Symrise has increased its equity by around €400 million to finance its planned acquisition of French food ingredient maker Diana for €1.3 billion.

Diana, with sales of around €425 million and an EBITDA margin of around 21%, is a leading supplier to the food, pet food, nutraceutical, aquaculture and cosmetics industries. Symrise said the buy would enable it to significantly expand its position in the flavor and nutrition markets and broaden its activities into the pet food markets. (dw)

BASF Cuts Jobs in Nutrition & Health

BASF plans to eliminate 260 jobs in its Nutrition & Health division up to 2015 to improve the profitability of its Performance Products business segment. At the same time, the German group said it will continue to analyze "further measures" to strengthen competitiveness.

The division bundles products and solutions for human and animal nutrition, flavors and fragrances industry as well as pharmaceuticals. In the Performance Products segment as a whole, EBITDA decreased by 5% in 2013 to €1.99 billion, with sales down 1% to €15.5 billion.

In future, marketing, sales and administration in the Nutrition & Health will be "better adjusted to regional market dynamics," BASF said. A global team responsible for marketing and innovation will support the development of customer-oriented products and solutions as well as faster market launches of new products.

Strategic partnerships in regional markets appear to be the chosen path for the world's largest chemical producer. In Asia, BASF is building a citral plant with Malaysian chemical giant Petronas to meet the growing demand of customers in the flavor and fragrance industry in the region. The first plants are expected on stream in 2016.

In future, the group said it will focus its production in the growing market of omega-3 fatty acids on the "attractive market segment" for highly concentrated omega-3 fatty acids. It plans to sell the Brattvåg site in Norway, where it produces low concentrated omega-3 fatty acids. (dw)

Zimmer to Buy Biomet for $13 Billion

US-based Zimmer Holdings will buy rival orthopedic products maker Biomet for $13.35 billion. The deal announced at the end of April is the latest in a wave of consolidations in the healthcare industry. It is also the latest successful exit for private equity. In 2007, Biomet was acquired for $11.3 billion by Blackstone, Goldman Sachs's buyout group, Kohlberg Kravis Roberts and TPG Capital.

The deal is expected to take Zimmer from the fourth-largest seller of orthopedics products to no. 2, behind Johnson & Johnson.

Zimmer, which expects to close the deal in the first quarter of 2015, said the combination would double the size of its spine and dental business, broaden its portfolio of products to treat bones, knees and hips, and give it an entry into the smaller but growing field of sports medicine.

The deal will also significantly add to the company's earnings in the first year and is expected to lead to net annual cost savings of about $270 million by the third year after closing. (dw)

DuPont Rethinks Spin-off Mode for Performance Chemicals Business

DuPont has indicated that it may be rethinking the planned spin-off to shareholders of its Performance Chemicals segment announced in October 2013. The $7.2 billion business includes the white pigment titanium dioxide (TiO2) as well as fluorochemicals and polymers.

Although the separation process is still on track for mid-2015, chief financial officer Nicholas Fanandakis told a Goldman Sachs conference the group is considering alternatives to a conventional spinoff to shareholders.

Fanandakis said DuPont may consider a so-called Reverse Morris Trust transaction, which combines a spin-off with a statutory merger. This means that the transfer is tax-free if the spin-off acts as buyer of another company.

Analysts suggest that DuPont may be looking to unload the business toTiO2 producer Tronox - a 2006 spin-off from the former Kerr McGee. Another alternative could be an outright sale.

A deal with Tronox could face anti-trust issues, as DuPont is the biggest player with a share of 20% of the $14 billion TiO2 market. Tronox, whose portfolio is based to 85% on TiO2, is regarded as number 2. All of the market's players have suffered from lower prices and higher costs for some time, and a merger could be expected to create more critical mass and better pricing opportunities. (dw)

Total Says LNG Unit Not Now for Sale

Total has not put its liquefied petroleum gas unit Totalgaz up for sale, the group said after Paris newspaper Les Echos in late April reported that the French oil and petrochemicals major had received around 10 expressions of interest from potential buyers. "There is no sale process of Totalgaz at the moment," a spokesman said, adding that options for the unit were being reviewed. (dw)

Koch Industries Rides US Shale Boom With PetroLogistics

Refining, chemicals and biofuels company Flint Hills Resources, a subsidiary of Wichita, Kansas-based Koch Industries, will take Texas-based PetroLogistics private in a deal worth $2.1 billion. The company with net income of $175 million in 2013 on sales revenue of $757.5 million owns and operates the world's largest-capacity propane dehydrogenation plant, which can produce 1.45 billion t of propylene. Both chemical and polymer grade are produced at its facility located on the Houston Ship Channel.

To gain control of a plant that can convert cheap US shale gas into propylene, which it sells to major chemical producers such as Dow, BASF, Ineos and Total, Koch is also buying all of the membership interests in general partner PetroLogistics GP and assuming the company's unquantified debt.

"PetroLogistics' capabilities are well aligned with our existing chemical and refining business," Flint Hills CEO Brad Razook said in a statement.

Flint Hills will pay $14 in cash for each PetroLogistics unit to minority shareholders who own 27% of the company. A group of shareholders who control the remaining 73% will receive $12 per unit.

The latter group includes Lindsay Goldberg, York Capital Management, PetroLogistics' executive chairman, David Lumpkins, and its chief executive, Nathan Ticatch.

Minority shareholders will get $526.2 million, while the majority shareholders will get $1.22 billion, according to news agency calculations.

Through Flint Hills, Koch Industries is North America's ninth largest producer of polypropylene with 937 million lbs (about 452,000 t) of annual capacity, according to estimates. It acquired the facilities in Longview, Texas, and Marysville, Michigan, along with a cracker at Port Arthur, Texas, from Huntsman in 2007.

Flint Hills also produces the propylene derivative cumene and operates 670,000 barrels a day of crude-oil processing capacity in Minnesota, Texas and Alaska. (dw)

Good Manufacturing Practices

Quality Management is Crucial in the Production of Active Pharmaceutical Ingredients and Intermediates

Regulatory Requirements — Good Manufacturing Practices (GMPs) represent the minimum requirements that must be satisfied when producing pharmaceuticals for human or veterinary use. They mandate a high degree of control over all stages of the manufacturing process, from ordering the raw materials through to packaging and dispatching the finished goods. All aspects of production must be described in written procedures, and all production activities must be thoroughly documented as they are carried out.

GMPs may be viewed as the third element of a trio of "GXP" regulatory requirements, which comprise also Good Laboratory Practice (GLP) and Good Clinical Practice (GCP).

Under GMP, manufacturers are also expected to embrace novel technologies as they emerge, where these offer significant quality improvements. Examples are the use of more accurate engineering control systems, surface coating materials which are easier to clean and sanitize, and more sensitive techniques for chemical analysis. It is not that innovation must be embraced for its own sake; the cost of a novel measure must be considered in relation to the quality improvement it brings. However, the industry "benchmark" standards do evolve over time, hence prevalent use of the acronym cGMP (current GMP).

1. Quality Management

For an organization to be compliant with cGMP, the most fundamental requirement is to have an effective quality management structure. Quality should be the responsibility of all persons involved in manufacturing, but the system must be defined and overseen by an independent Quality Unit, which is separate from all production activities. The manager of this Quality Unit should report to a senior level of the organizational hierarchy, and should not be subordinate to the production manager. The quality unit should be involved in all quality-related matters, and should review and approve all quality-related documents.

The quality unit should fulfill the functions of quality control (QC) and of quality assurance (QA), though these may be organized as separate units if desired — depending on the size and structure of the company. The QC function normally comprises the analytical work carried out to ensure that specifications are met — e.g. for raw material quality, equipment cleanliness or air quality. QA has a more wide-ranging role and has been defined (in the Q7A guideline) as "the sum total of the organized arrangements made with the object of ensuring that all active pharmaceutical ingredients (APIs) are of the quality required for their intended use and that quality systems are maintained".

One important Quality Unit responsibility is to ensure that internal audits, or self-inspections, are regularly performed to determine whether established procedures are being followed and whether the cGMP regulations and guidelines are being observed. The audit findings and/or corrective actions should be documented and brought to the attention of responsible management.

Regular quality-reviews of APIs should be conducted at least annually, comprising in-process control and test results, batch failures, deviations, nonconformances, process or analytical changes, stability results, complaints, and returns. The results of these reviews should be evaluated and an assessment made as to whether any corrective action is required.

2. Principal Requirements of GMP

The main provisions can be divided into requirements for Personnel, Materials, Premises and Equipment, and Processes.

2.1. Personnel

Personnel are often the most significant source of variance in a process, and most failures can ultimately be traced to human errors. A drug manufacturer should therefore employ an adequate number of personnel with the necessary qualifications and practical experience to perform and/or supervise the required tasks. The structure of the company should be set out clearly in an organization chart, and all personnel should have specific duties recorded in written job descriptions. Training in the particular operations that the employee performs, and in the cGMP regulations that relate to his/her function, should be conducted regularly by qualified instructors. Records of such training should be maintained, and its effectiveness should be periodically assessed. Appropriate clean protective apparel should be provided, and staff should practice good sanitation and health habits.

2.2. Materials

All process materials must be carefully controlled to ensure they are only used in those processes for which they have been approved. This means maintaining proper storage facilities, where clear distinctions are made between materials which are quarantined, approved, or rejected/returned. Appropriate specifications should be developed for all starting materials, reagents, processing aids, solvents, water, and primary packaging materials, as well as for the final APIs and key intermediates. Each individual batch or lot should be uniquely identified and evaluated against its specifications before being approved for use in any process. The evaluation should normally be carried out by the quality unit; however, for some of the earlier less critical manufacturing steps, it may be performed by production personnel, following QU-approved procedures. All incoming materials should be sampled, and at least one identity test performed. In many cases it is acceptable to rely on a supplier's Certificate of Analysis as evidence of the required quality, as long as confidence in that supplier can be justified on the basis of a quality audit or other evaluation process and of satisfactory experience. Randomly selected lots of all incoming materials should be subjected to full specification testing from time to time. Whenever a material is used in a process, its lot number and the precise amount dispensed should be recorded on the batch production record, so that all materials are traceable back to their original sources. Records should also be kept on the disposition of each lot.

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2.3. Buildings, Facilities, and Process Equipment

Buildings and facilities used in the manufacture of intermediates and APIs should be located, designed, and constructed to facilitate cleaning, maintenance, and appropriate operations, and to minimize the potential for contamination. There should be defined areas, or other control systems, for distinct operations such as receipt, sampling, quarantine, storage, processing, packaging, and laboratory activities. Adequate lighting should be provided in all areas. Adequate ventilation, air filtration, and exhaust systems are required for those environments where the final API is isolated, dried, or packaged. Such areas should have smooth, continuous, and impermeable surfaces, with no sharp corners. API processes should ideally be physically segre-

Lilly and Sanofi Pursue OTC Status for Impotence Drug

US drugmaker Eli Lilly has struck a licensing deal with Sanofi that would allow its French rival to pursue regulatory approval for a non-prescription version of Lilly's erectile dysfunction treatment Cialis.

Cialis was first approved by the European Medicines Agency in 2002 and by the US Food and Drug Administration in 2003. Last year, it generated $2.16 billion in worldwide sales, passing Pfizer's Viagra, which had sales of $1.9 billion. Since its launch, the Lilly drug has racked up total sales of more than $14 billion.

Under the terms of the agreement, Sanofi will acquire exclusive rights to apply for approval of Cialis tablets to be sold over the counter in the US, Europe, Canada and Australia.

The drugmakers say an OTC version of Cialis could provide easier treatment for impotence sufferers and also help stem the illicit online sale of fake or stolen products. Observers also see the move to sell an OTC version as an attempt to extend patent exclusivity.

Pharmaceutical experts say Sanofi will have to demonstrate to regulators that men can correctly decide whether to take the drug without a doctor's guidance.

In 2007, Pfizer applied to European regulatory authorities for approval of an OTC status for Viagra, but withdrew the application a year later after it appeared that permission would not be given. (dw) ■

US Court Dismisses Teva Case to Block Generic Copaxone

Shortly before expiration of the patent on the multiple sclerosis treatment Copaxone, a US district court dismissed a case by Teva Pharmaceutical Industries, subsidiary of the Israeli drugmaker, to block approval of a generic form of the drug.The court said the suit was being premature because the US Food and Drug Administration (FDA) had not yet approved or rejected the applications for generic forms of the drug.

Teva had also asked the court to impose clinical trial requirements on companies applying for approval of generic versions. Oral arguments in the case will begin in the Supreme Court at its 2014 term beginning in October of this year.(dw)

■

Roche Invests at Basel and Mannheim Sites

Swiss pharmaceutical producer Roche plans to invest 120 million Swiss francs in new production facilities at Basel.

Around €85 million of the total will go for new chemical ingredients, the remainder in expansion and retrofitting of an existing flexible multipurpose unit for investigational medicines already on the market.

Roche said initial preparatory work has begun, and production of the drug ingredients will start up in the third quarter of 2016, while the multipurpose plant will go on stream in June 2015.

Site manager Matthias Baltisberger said the investment is designed to enhance the site's appeal and "continue to provide jobs for highly skilled technicians, scientists, engineers and quality specialists."

Roche is also to invest €90 million in the construction of a new laboratory building at its Mannheim, Germany site. The new facility will be designed to conduct quality control and long-term stability testing of products from the pharmaceutical and diagnostics businesses of Roche.

According to company estimates, the volume of quality controls in the pharmaceutical sector at Roche in Mannheim will increase by about 10% annually in the next few years. The diagnostics division anticipates growth, too. (dw)

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Codexis Reports First Quarter 2014 Financial Results

Codexis announced financial results for the first quarter ended March 31, 2014. Revenues for the first quarter of 2014 were $7.1 million, a 38% decrease from $11.5 million in 2013. Biocatalyst product revenue was $3.0 million, a 67% decrease from $9.1 million in the prior year quarter. The decrease was primarily due to an expected loss of biocatalyst and intermediate sales in the hepatitis C drug marketplace, as a result of both unfavorable market pricing and newer products entering the market, along with a one-time enzyme inventory sale of $2.1 million to Arch PharmaLabs recorded in the first quarter of 2013.

"Codexis is off to a solid start in 2014, now fully focused on our core strategy of growing our biocatalyst business serving pharmaceutical drug development and manufacturing," said John Nicols, President and CEO of Codexis. (dw)

■

Read more about this topic in Ullmann's

This article is an excerpt from the Ullmann's Encyclopedia of Industrial Chemistry (wileyonlinelibrary.com/ref/ullmanns) which celebrates its 100th anniversary in 2014. More about the topic can be found in the encyclopedia article on **Good Manufacturing Practices**. More concept articles on general interest topics in industrial chemistry and chemical engineering can be found on the Ullmann's Academy homepage (onlinelibrary.wiley.com/book/10.1002/14356007/homepage/ullmann_s_academy.htm).

gated from one another; if this is not possible, then adequate procedures should be established which prevent cross-contamination.

Utilities such as steam, gas, compressed air, heating, ventilation, and air-conditioning should be qualified and appropriately monitored wherever they may affect product quality. Drawings for these systems should be available, and appropriate operating limits should be established.

All processing equipment should be of appropriate design and adequate size, and suitably located for its intended use, cleaning, sanitation, and maintenance. Any surfaces which directly contact the raw materials or products should be constructed of unreactive materials which will not adversely affect the quality of the API (e.g., steel equipment may not be appropriate for processing corrosive materials such as hydrochloride salts). All instruments should be regularly calibrated to ensure they consistently operate within defined tolerances.

Critical equipment and facilities should be formally qualified to demonstrate their suitability for the required operations and their conformance to predetermined specifications. Qualification will normally be conducted in different phases, beginning with a Design Qualification (DQ), in which the manufacturer's designs, blueprints, and specifications are compared with the user's own requirements to assess whether the basic concept will meet the defined process demands. Once the item has been installed and commissioned, it should go through the Installation Qualification (IQ) stage, which is a checklist to confirm that all the necessary functionality (switches, gauges, electrical connections, etc.) is present and of a suitable standard. The next stage is an Operational Qualification (OQ), in which the equipment is set to work on a typical task or process (usually employing inert materials), and details of its performance are collected and assessed. Finally, in the Performance Qualification (PQ), a trial run of a real process is conducted. (This PQ may be performed as part of the validation of that particular process.)

All equipment should be subject to a regime of planned preventative maintenance, to ensure that it continues to operate within its specifications, and to detect and rectify any potential problems at an early stage before they cause any batch failures.

In some cases it may be necessary to dedicate the equipment to particular processes, most notably for the production of highly sensitizing products such as penicillins.

Equipment should normally be cleaned to a satisfactory standard after each individual batch to prevent cross-contamination between batches and, most importantly, between different products. Equipment dedicated to one process or used for a multibatch campaign of the same product may be cleaned less frequently, but this should be justified on a case-by-case basis.

Companies are expected to establish their own cleanliness criteria based on an assessment of their own circumstances. Normally the criteria will include the requirement for no visible residue on the equipment surface. Where the surface is not completely accessible for visual inspection, some indirect means should be established, such as a rinse test or a swab test, with defined residue limits. Such limits should be rational, practical, achievable, and verifiable. For example, some companies operate on the 10 ppm principle, whereby limits are set to ensure that the following product cannot be contaminated with more than 10 ppm of the previous product. Other companies set limits to ensure that the maximum daily dose of the following product cannot be contaminated by more than 0.1 % of the minimum daily dose of the previous product.

Cleaning after each process should be defined in written procedures, which should be validated to ensure that they consistently achieve the defined standards. Cleaning validation involves identifying the areas of the equipment which are most difficult to clean and demonstrating that they are in fact cleaned to the required standard over a number of consecutive (usually three) runs. This may involve dismantling the equipment to some extent to reach otherwise inaccessible areas. However, cleaning validation need only be performed on a "worst-case" basis, that is, on those processes which are judged to present the greatest cleaning difficulties.

2.4. Processes

The production of each batch of API or intermediate should be closely documented to provide as complete a record as possible of the circumstances of its manufacture. To ensure uniformity from batch to batch, master production instructions should be prepared, dated, and signed by one person and independently checked, dated, and signed by another person in the quality unit. The master instructions should give details of all process materials required, including packaging and labeling, with their quality specifications and amounts. The major production equipment should be specified, along with detailed production instructions, including sequences, allowable ranges for process parameters, sampling instructions, in-process controls, time limits for completion of individual steps, and expected yield ranges at appropriate phases. Each individual batch should conform as far as possible to these master instructions, with any deviations being recorded, investigated, and evaluated.

Each individual batch production record should identify the operators and supervisors involved with the batch, record equipment numbers, the dates and times of each critical operation, the lot numbers of each ingredient used and the precise amounts dispensed, the actual results recorded for critical process parameters and in-process controls, actual yields at appropriate phases, details of any process deviations, and results of release testing.

2.5. Process Validation

A formal validation is required for all operations determined to be critical to the quality and purity of the API. Process validation is often a very time consuming and laborious activity; therefore, many companies perform it only on the final synthetic steps, relying on quality control and other GMP measures to assure the quality of the earlier, less critical intermediates. A written validation protocol should be established that specifies how the validation of a particular process will be conducted. This should identify the critical product attributes of the API (e.g., analytical specifications, physical form), and the critical process parameters (e.g., temperatures, stoichiometry) which may affect these attributes. For each critical parameter a normal operating range, a proven acceptable range, and, where appropriate, edge of failure limits, should be established. A series of consecutive validation runs (usually three) is then undertaken to establish that the process consistently falls within the defined ranges for each parameter and that the product consistently meets its quality specifications.

Validation studies should normally be completed before any commercial distribution of the API (Prospective Validation). For most new drugs, FDA approval will be withheld until the agency is satisfied that an adequate validation has been performed.

Once a process has been validated, strict controls must be enforced to prevent unauthorized changes. Any proposed changes to the process should be formally evaluated for the effect they may have on the critical quality attributes of the API. If a process change is judged to be major, i.e., it has the potential to influence the quality of the product, then its introduction should be preceded by a revalidation of the process. Minor changes which are judged unlikely to affect product quality may be implemented without formal revalidation, provided they give an equivalent input to the process. (For example, if the starting material is obtained from a new supplier, it should meet the same qualitative and quantitative specifications as that from the previous supplier.) Each process should be reviewed on a regular (perhaps annual) basis to assess how far it has shifted since its last validation, and a judgment should be made as to whether revalidation is required.

Derek Robinson, Monmouthshire, United Kingdom

References are available upon request. ■

Nestle Boosts Skincare Business With Valeant Deal

Swiss food group Nestle has accelerated a push into the fast-growing skincare market, buying the rights to several injectable treatments for facial wrinkles and lines from Valeant Pharmaceuticals International for $1.4 billion.

The world's biggest food group signaled its ambitions in skin health products in February by taking over all of its Galderma dermatology joint venture with L'Oreal. Nestle now owns North American rights to some products taken on as part of that deal, boosting its control of the brands.

For Quebec-based Valeant, the cash deal clears a potential anti-trust hurdle to its proposed $49 billion takeover of US rival Allergan, manufacturer of Botox (c.f. page 2).

Citing data from GlobalData Facial Esthetics, analysts said the US market for Botox and other wrinkle fillers is set to grow from $2.5 billion in 2013 to $4.7 billion in 2018 - compound annual growth of 13.5%.

Nestle said the deal with Valeant would give it US and Canadian rights to sell the Restylane, Perlane and Emervel injectable cosmetic treatments it already manufactures, as well as Dysport, a cosmetic treatment owned by Ipsen.

It is also acquiring from Valeant a skin filler for cosmetic and medical use called Sculptra.

Beside its new skin health division, Nestle has a unit called Nestle Health Science that sells medical nutrition products for people with specific dietary needs related to illness or disease. It is also on a shortlist of bidders for the medical nutrition business of Danone, valued at about €4 billion, sources told the news agency Reuters.

Nestle Health Science is working as well to develop products in gastrointestinal, metabolic and brain health. (dw) ■

Bayer Selling Interventional Devices to Boston Scientific

Bayer HealthCare has announced a "definitive agreement" to sell its Interventional device business to Boston Scientific for $415 million. The sale include devices used in cardiology, radiology and peripheral vascular procedures. Closing is set for the second half of this year, following all approvals. The business had $120 million in sales in 2013.

"With this sale, our Medical Care division can concentrate on innovation and growth in radiology and diabetes care where we already have a strong presence," said Olivier Brandicourt, CEO of Bayer HealthCare.

In radiology, Bayer claims global leadership in contrast-enhanced diagnostic imaging equipment, contrast agents and informatics for Total Dose Management (contrast and radiation). In the diabetes franchise, the German group is regarded as a technological leader in blood glucose monitoring systems, lancing devices and diabetes management software. (dw) ■

Evonik Starts Medical Devices Project House, May Make Acquisitions

Evonik, has launched a Medical Devices Project House. The facility, the company's 11th R&D project house, has its main campus in Birmingham, Alabama, in the US, and a branch in Hanau, Germany.

The aim of the new project house is to develop new system solutions for medical technology and to expand the company's competence in biomaterials and polymers.

Peter Nagler, chief innovation officer at Evonik, said the company wants to open up new growth opportunities in the medical technology market, which is worth €300 billion and enjoys annual growth rates of 6%. The US accounts for 40% of the market.

Germany's second-largest chemical producer behind posted earnings down nearly 25% for the 2014 first quarter and said it may cut its €6 billion investment budget launched in 2012. Klaus Engel, CEO of the Essen-based group said that spending could be delayed and the program might be reduced by 10-15%.

While soft-pedaling capital expenditure, Engel said Evonik would look for acquisitions worth more than €1 billion to strengthen its portfolio. He did not rule out larger takeovers or using equity financing. Minor acquisitions might come in the course of the year, he said. (dw) ■

New Opportunities for Process Chemical Producers

Catalyst Technologies Play a Crucial Role in Dealing with the Big Changes in Oil and Gas Feedstocks

Refining and Petrochemicals

— The golden age of refining which peaked in the first decade of this century is over. Now oil refining has become a far more complex operation. Since refineries supply most petrochemical feedstocks, their current plight, particularly in Europe, has a major impact on the petrochemical business as well.

However the changes in refining and petrochemical feedstocks are giving new opportunities to producers of catalysts, additives and other process chemicals required by the two sectors. In particular they are providing openings for developers of new technologies which enable refineries and petrochemical plant operators to be more flexible and cost effective in responding to the needs of the market.

The major beneficiaries of the new trends are the developers and manufacturers of catalysts which are crucial to the efficiency of most refining and petrochemical production processes. Perhaps the trend which has affected the demand for process chemicals and catalysts the most has been the swing to heavy oil feedstocks. Previously the prevalence of light, relatively clean oils made refining much easier technologically and much more profitable. Heavy oils, some highly contaminated with sulphur and metals, are more difficult and costly to break down into the fuels demanded by the transportation market and into the feedstocks required by petrochemical companies.

Market Effects

In North America the shale boom has made refining more intricate because refineries are having to cope with a much wider range of oil types. Many refineries in the region have been gearing themselves to deal with ultra heavy oil from oilsands in Canada. But at the same time they are having to cope with increasing amounts of shale oil, which is light but with highly varied properties.

Another major influence on refinery processes is tightening environmental regulations which lead to stricter automobile fuel standards not only in North America and Europe but also in emerging markets like China. The most widespread regulatory initiative has been mandatory cuts in sulphur levels so that low sulphur fuels have become obligatory across much of the world.

These regulatory requirements are pushing up costs at a time when excess capacity is squeezing refinery margins. Yet for chemical companies supplying catalysts, additives and other process chemicals to refineries and linked petrochemical operations the sector can be a profitable market.

Market Players

The catalysis and energy business of Clariant, much of it in catalysts for refining and petrochemicals production, reported a 5% drop last year in sales to 713 million Swiss francs ($806 million) and 2% fall to 159 Swiss francs in earnings before interest, tax, depreciation and amortisation (EBITDA). Nonetheless the EBITDA margin on sales rose slightly to 22.3%, reinforcing its position as one the company's most profitable operations.

BASF also recorded what it said was a "significant earnings increase" in its catalysts division last year "mostly on account of higher margins" for refinery catalysts and higher sales volumes for automobile catalysts. Total catalyst sales went up 3% to €5.7 billion.

W.R. Grace & Co., Columbia, Maryland, reported a 11% decline to $1.1 billion in the sales of its catalysts technologies operation in 2013 while its EBITDA decreased by 15%. Nonetheless the EBITDA margin of the business which covers mainly refining and petrochemicals went down only marginally to 34%.

Among the leading suppliers of fluid catalytic cracking (FCC) catalysts for refineries, BASF has been active in the development of catalyst technologies for dealing with heavy oils so that refineries can respond quickly to variations in properties of crudes and also the needs of the fuels and petrochemicals sectors. "Flexibility in (FCC) operation will be key for refiners looking to capture market opportunities and regain healthy margins,"

BASF says in a recent technical note. The note was about BASF's latest version of its Distributed Matrix Structures (DMS) catalyst technology

© Giuseppe Porzani - Fotolia.com

comprised of highly dispersed zeolite crystals. The matrix design and the process for its manufacture ensures that the oil cracks on the zeolite surface itself rather than amorphous material as in other FCC catalyst systems. This results in improved yields and selectivity. In particular it lowers the amount of refinery feed which is turned into a carbonaceous solid or petcoke which remains unprocessed and is sold as a relatively low value fuel or as a raw material for making electrodes for the steel and aluminium industries.

Usually the proportion of petcoke residues is much higher with heavy refinery feeds than light ones. Consequently a lot of effort is being put into the development of technologies which enable traditionally low-value residues to be converted into high-value fuels, hydrogen and petrochemical feedstocks. One option is the gasification of petcoke residues which have similar properties to coal but with a higher energy content. Gasification produces syngas a combination of carbon monoxide and hydrogen which can be synthesised by catalysis not only into fuels but also base chemicals.

In India Reliance Industries (RIL) is due to bring on stream next year a $4 billion petcoke gasification project at its refinery at Jamnagar, Gujarat, for making fuels, hydrogen and feedstock chemicals for a new adjacent $4 billion petrochemicals complex. RIL's long-term objective is to create a centre of excellence in gasification at Jamnagar which will gasify not only petcoke but also coal, lignite and biomass.

The Jamnagar gasification unit now being constructed will be based on a entrained flow gasifier technology of Texas-based CB&I, which is one of the world's biggest refining and petrochemicals technology companies. The unit is linked to a range of downstream catalyst-driven units of other technology providers for the supply of energy for power generation, hydrogen and carbon monoxide for making acetyls and their derivatives.

The CB&I technology also includes a system for sulphur removal which is now an essential requirement of environmental regulations on industrial emissions and clean fuels. As a result desulphurisation has become a busy area of research to increase the cost effectiveness of technologies for dealing with sulphur-rich heavy oils. Not only do the sulphur emissions from refineries and petrochemical sites have to be controlled but the sulphur content of transportation fuels cut from 500 parts per million to a mandatory limit of 15-10 ppm in most developed countries.

Much of the advances have been improvements to the hydrodesulphurisation catalytic process for breaking the sulphur-carbon bonds in oil and to the standard catalytic Claus process for converting the hydrogen sulphide into elemental sulphur.

However the heavier the oil the more use also has to be made of other methods such as the application of solvents, thermal treatment, reduction-oxidation and ionic liquids.Shale oil, which is accounting for a growing proportion of refinery feeds in the U.S., has a low sulphur content but can be contaminated with a variety of solids and metals, which can form sludge and waxes and cause fouling of catalysts.

High levels of iron in some shale oil are combining with silica, calcium and sodium to curb the activity of zeolite-based catalysts by lowering their melting temperature. W.R Grace has designed catalysts with alumina-based binders and matrices to resist the effects of the iron and calcium contamination.

Switch from Naphtha to Ethane

The surge in shale gas output in the U.S. has a precipitated big switch in the country's steam cracker capacity from naphtha to ethane feedstocks. This has lowered the country's output of propylene, the main co-product of naphtha-based ethylene crackers, which has led to a shortage of propylene for the manufacture of polypropylene and other chemicals. Propylene scarcities in North America have helped accelerate a trend to the building of on-purpose propylene facilities as an alternative source. Within a few years the proportion of new propylene capacity based on the main on-purpose processes of olefins metathesis and propylene dehydrogenation (PDH) could rise from less than 5% to over 30%, according to CB & I. Through its Lummus Technology business, which also licenses the gas-phase polypropylene Novolen technology, it provides both on-purpose technologies.

Under Construction

Several PDH plants are being constructed in the U.S., as well as a number in the Middle East, to take advantage of low gas prices. The growth in international trading of propane, a lot of it sourced from the U.S., has prompted at least five PDH projects in China.

Clariant and CB&I last year strengthened an alliance in the polypropylene chain which reinforces the combination of expertise of Clariant in catalyst development and manufacture with that of CB&I in process design.

The two companies announced a co-operation agreement under which licensees of the polypropylene process technology of Lummus Novolen Technology, Mannheim, Germany, will be supplied with a new Clariant polypropylene catalyst. Lummus Novolen is investing, as part of the deal, in a new polypropylene production line at Clariant's catalyst production hub in Louisville, Kentucky. The agreement complements an existing co-operation between both companies in propylene under which Clariant's Catofin catalysts are used in CB&I's process for propane dehydration.

The Clariant/CB&I collaboration in the propylene value chain underlines the importance of catalyst producers in the shaping of the future of refining and petrochemical production technologies in the face of big changes in the oil and gas sectors.

Sean Milmo, freelance science and business journalist, Essex, United Kingdom

BASF to Build New PAG Plant at Ludwigshafen

BASF plans to invest a "double digit million euro" sum in a new plant at Ludwigshafen for lubricants based on polyalylene glycol (PAG) and blends. The facility, for which no capacity is given, is due to start up in early 2016. The German group said the new capacity, back-integrated into ethylene and propylene oxide, will support global growth of synthetic lubricant formulators. (dw) ■

Clariant Catalyst Selected for Chinese Isobutylene Plant

Shandong Chengtai Chemical Industry Co has selected the Catofin catalyst manufactured by Swiss specialty chemicals producer Clariant for a new grassroots iso-butane dehydrogenation unit it is building in Changyi, Shandong Province. The contract for the license and engineering design has been awarded to CB&I, and the plant will use the company's dehydrogenation technology to produce 114,000 t/y of isobutylene as a building block to produce MTBE and other downstream products. (dw) ■

Air Liquide Begins $230 Million Bayport Redevelopment

Air Liquide is investing some $230 million to redevelop its Bayport, Texas, complex by 2015. Work is focusing on upgrades to the site's cogeneration units capable of generating both steam and electricity, with a minimum amount of wasted heat.

Much of the Air Liquide's excess steam and power produced at Bayport has already been contracted to Rotterdam-headquartered chemical producer LyondellBasell, one of the French industrial gases producer's neighbors and customers, but it expects to have additional capacity to sell to other customers throughout the region. (dw) ■

Styron to Permanently Close Texas PC Plant

US styrenics producer Styron, alternately known as Trinseo, said it plans to close its only North American polycarbonate plant, at Freeport, Texas, by the end of 2014 and exit PC production. Material for compounding will be insourced. The plant with a capacity of around 100,000 t/y officially belongs to the company's former parent Dow Chemical. The former Dow styrenics unit also produces PC at Stade, Germany, and at Niihama, Japan, as part of a joint venture with Sumitomo. (dw) ■

Evonik Starts Isophorone Complex in China

Germany's Evonik has started up an integrated production complex for isophorone and isophorone diamine at Shanghai Chemical Industry Park (SCIP) in China. The plant with annual capacity of more than 50,000 t/y, built at a cost of more than €100 million, will supply the Asian paints and coatings, construction, adhesives, and composite industries. (dw) ■

Technip Awarded New LNG Contract in China

French engineering contractor Technip has been tapped to provide engineering, procurement and technical assistance for a liquefied natural gas (LNG) plant being built by Fengzhen Wanjie Gas Co. at Fengzhen City in China's Inner Mongolia Province. The facility slated for start-up in the second half of 2016 will consist of a 1.3 million Nm³/d LNG train and a 0.3 million Nm³/d compressed natural gas (CNG) station. (dw) ■

BASF-Huntsman Chinese MDI Plant to Double Output

Lianheng Isocyanate, the joint venture of BASF and Huntsman and Chinese partners has received permission to double its MDI capacity in the Shanghai Chemical Industry Park (SCIP) to 480,000 t/y from the current 240,000 t/y.

The new capacity at the $1 billion complex, which went on stream in mid-2006, is due to be in place by 2016. The plant also produces MDI precursors aniline and nitrobenzene. BASF and Huntsman each own 35% of the Lianheng Isocayanate, with the remainder in the hands of Shanghai Hua Yi, Sinopec Shanghai Gao Qiao Petrochemical Corp. and Shanghai Chlor-Alkali Chemical Co. (dw) ■

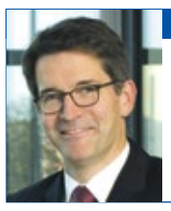
Williams May Add Second Ethane Cracker at Geismar

US chemicals and energy giant Williams may add a second ethane cracker at its Geismar, Louisiana, complex. The company said it is seeking partners for the project that could cost $5 billion or more and have a capacity of 1.5 million t. John Dearborn, Williams' senior vice president of NGL and petchem services, said the existing cracker, Geismar 1, has been expanded about as much as possible. The plan is to build a new, large cracker, Geismar 2. Williams did not disclose the estimated cost of the cracker or capacity, but it is expected to be about the same size as Sasol's world-scale ethane cracker in Lake Charles, being built at a cost of $5-7 billion. (dw) ■

What's in Your Engine?

HCS Group puts PCL Performance Fuels and Haltermann Test and Reference Fuels under one roof

Fill' er up — Have you ever wondered what propels a racing car, a rally car, or dirt bike to insanely high speeds? Courage? Skill? A strong engine? A lead foot? Yes, to all, plus, on racing circuits around the world, Hiperflo.



Henrik Kruepper
member of the management board, HCS Group

Dr. Uwe Nickel
CEO, HCS Group

You cannot pump Hiperflo at your local station, but you can see its results in action at FIA motorcar and FIM motorcycle races including international events like the World Rally Championship.

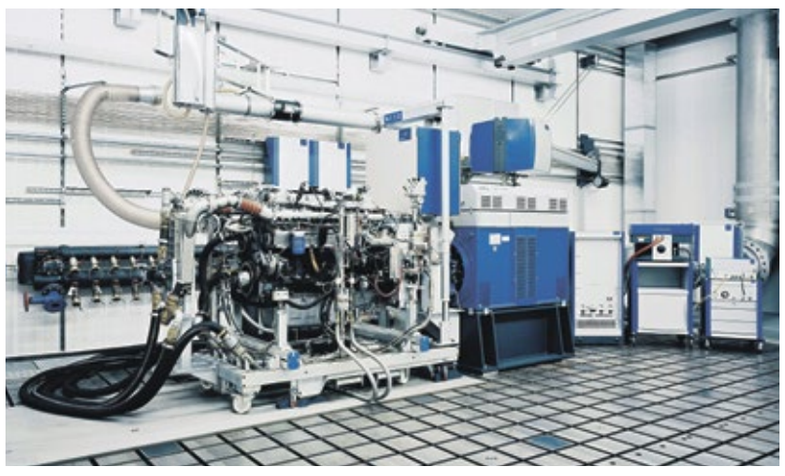
Hiperflo is a range of advanced, high-performance racing fuels produced by the Performance Fuels unit at Petrochem Carless Ltd. (PCL). Performance Fuels is one of PCL's five business lines that were acquired in April 2013 by HCS Group. The acquisition put PCL and Haltermann under common management.

"Our highest expectations were exceeded," said Henrik Kruepper, member of the management board at HCS Group. "There is an excellent fit between the Performance Fuels activities at PCL and at Haltermann, bringing together two long-standing and strong brands."

Road Testing and Race Testing Renewable Bio Fuels

In January 2014, Haltermann joined forces with Clariant and Mercedes-Benz to road test Clariant's Sunliquid process that converts wheat straw into cellulosic ethanol virtually CO_2-neutral. Haltermann then blends the ethanol with conventional fuel components and produces high-octane fuel with optimal efficiency, and without competing with food production or agricultural acreage.

"This straw-based fuel is compa tible with existing engines," said Dr. Uwe Nickel, CEO of the HCS Group. "Germany is a leader in research and development for sustainable special fuels." The practical road testing of the fuel for a year using Mercedes-Benz cars is aimed at demonstrating that the 20% ethanol fuel is ready for market and technically compatible with a variety of vehicles.

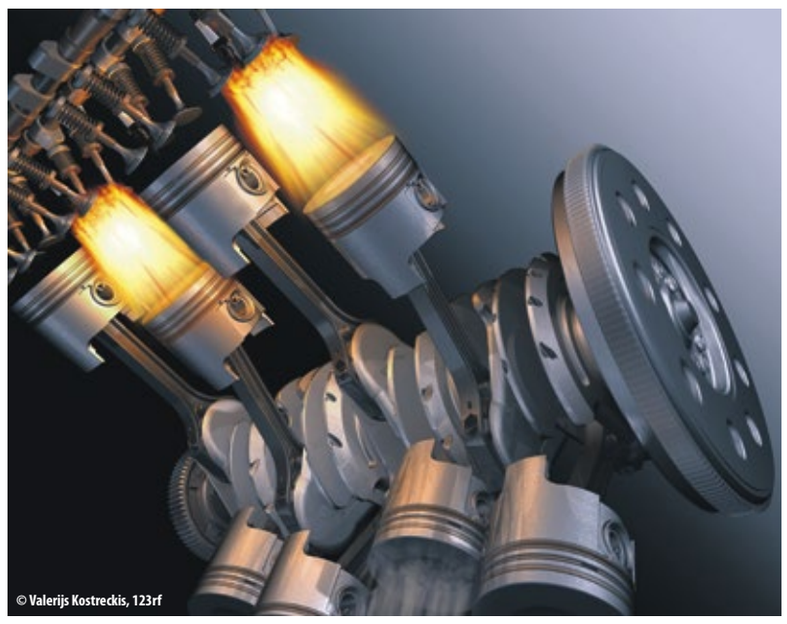


Engine test bench © AVL List GmbH

Both PCL and Haltermann produce a full range of bio-gasoline and biodiesel fuels. "We are working with blue-chip partners to supply second-generation biofuels in a number of applications including racing fuels", said Dr. Peter McKenna, technical services manager for performance fuels at PCL. In addition to Hiperflo, PCL also produces Carcal, a range of high-quality reference and calibration fuels used in research and development in the automotive and aerospace industries.

Sustainability Spoken Here

Haltermann sees a significant role for itself in supporting the industry in developing more and more sustainable, clean, low-emission fuels. The cooperative arrangement with Clariant and Mercedes-Benz for the Sunliquid project is just the beginning. "Sustainability is a priority for HCS Group," said Dr. Nickel. "We see Haltermann increasingly becoming the link between industries to advance sustainable solutions and bringing them to market, forming the interface between the petrochemical and specialty chemical industries."



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In addition to test and reference fuels, both Haltermann and PCL provide first fill fuels to OEM (original equipment manufacturer) customers. First fill fuels must be especially clean and meet very specific, high-performance criteria. Both of the HCS Group companies manufacture fuels tailored to customer specifications.

European Union Fuel Performance Requirements Take the Lead

Constantly increasing demands worldwide for higher-performing and more efficient automobile engines, coupled with ever more stringent environmental and emission standards, are making the European Union an important influence in future automotive fuel standards.

"We see EU standards being copied or adapted as blueprints for fuel standards worldwide," Henrik Kruepper, who heads HCS Group's Performance Hydrocarbons business segment, said.

"The increasing number of different fuel grades and sources and the changing political environment requires constant test work to keep engine technology fit for the future," said Lutz Reichenbaecher, product manager for performance fuels at Haltermann.

Both PCL and Haltermann produce fuels to exacting specifications. State-of-the-art blending equipment assures outstanding batch-to-batch repeatability. Storage facilities maintain fuels to identical specifications for up to eighteen months, providing the stability required by high-end testing and applications.

Fuel for Growth

Between the motorsport and reference fuels at PCL and the engine testing and reference fuels at Haltermann, "We see an increasing demand for our specialized fuels business, making it one of the strategic pillars of the performance hydrocarbons business segment at HCS Group," Mr. Kruepper said. "Our name stands for reliability, quality and flexibility."

"We are bringing the petrochemical and specialty chemicals industries together, making the benefits of both industries accessible to our customers. This works well because the specialty chemicals industry is not familiar with petrochemicals and vice versa," said Dr. Nickel, the HCS Group CEO.

The growing number of automobiles, particularly in markets such as China and India create a demand for enormous technical innovations. Test cycles for engines and fuels are becoming much shorter. HCS Group has the resources to meet the market requirements, both for today and in the future.

Mr. Kruepper added, "The key is not just the product but the technical expertise behind it. The combination of Haltermann and PCL gives the HCS Group a big competitive advantage because the products and expertise of the two companies complement each other."

References are available upon request.

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Partner for Peptides

Rebranding Rounds-off Bachems Concentration on Core Business

Time for a Change — Bachem is specialized in the process development and the manufacturing of peptides and complex organic molecules as active pharmaceutical ingredients (APIs), as well as innovative biochemicals for research purposes. The rebranding is the final step in the restructuring of the Swiss company. Dr. Birgit Megges interviewed Dr. José de Chastonay, CMO of Bachem, about the rebranding strategy.

Dr. José de Chastonay
CMO, Bachem

CHEManager International: In 2012 Bachem decided to refocus on their main business of peptide chemistry. Has the rebranding now been a logical consequence?

J. de Chastonay: Due to Bachem's change in strategy and the re-focus on the core business of peptides, the brand personality and tagline have no longer been in accordance with the new situation. An adaption has been inevitable, allowing us to realize a new, more contemporary brand appearance.

What is the message of the new slogan "Pioneering Partner for Peptides"?

J. de Chastonay: The new slogan perfectly matches the company's strategy. It states clearly who we are, what we do best and how we position ourselves in the industry. Apart from the strategy "Focusing on peptides", it transports further key messages, which characterize Bachem. Since the early 1970ies we are leading in the field of peptides, which is expressed in "pioneering". Equally important is the partnership aspect, which we are already known for. We are not only a service provider and manufacturer, but it is essential for us to perform projects in close collaboration with our customers, because this is the only way to achieve the best service and the best results.

Only changing the slogan is not enough. What else will change?

J. de Chastonay: The new strategy and the idea represented by our slogan, shall be lived within the Bachem group. We have to visualize the change for our employees and, as team, establish recommendations for the realization. In order to establish the new brand personality, we are in the process of a rebranding initiative. Fundamental is the clear communication of who we are today, how we want to develop in the future and how we will ensure our leadership claim.

The change is visualized by the unique appearance we created with the new logo, the new font, messages and, of course, the new slogan.

How will customers benefit from the rebranding?

J. de Chastonay: Our customers will benefit directly from the rebranding, because the partnership aspect has gained even greater significance in the collaboration. Our customers will benefit indirectly from us in the future, because we will continue enhancing our leading position in peptide know-how. This expertise is not only based on our company's history, but also on the importance of innovation for us. This combination makes us an attractive long-term partner.

Bachem is a leader in the peptide business. But there are also competitors. How do you differentiate?

J. de Chastonay: As an integrated service provider we support our customers in all development phases of a project, starting from early research and development, to API synthesis for clinical studies and further to commercial production of approved products. Biotech and pharmaceutical companies are our customers as well as research institutes. The variety of services qualifies us as a partner along the entire value chain. We are known for performing complex technical projects efficiently in a partnership collaboration together with our customers.

At present, which products are mainly requested on the market?

J. d Chastonay: The established peptide generics are being ordered regularly. An example is Goserelin for the treatment of prostate cancer and endometriosis. The number of products going into clinical phases is growing. But those are being ordered at irregular intervals. ■

A Place To Thrive

Industrial Parks' Benchmarking of Infrastructures and Services, Part 2: Energy, Utility and Traffic Infrastructures

Monitoring Maintenance — Based on a benchmarking study with nine chemical parks and chemical-related industrial parks in Germany described in part 1 of this series, part 2 describes maintenance of electric energy and utility infrastructures (steam, compressed air, industrial water, drinking water) and traffic infrastructures.

Electric Energy Infrastructures

Only maintenance costs for the distribution of electric energy and not those for the production were investigated, i.e., only maintenance of the grid and not of the power plants. All participants had the three voltage levels 110 kV, 30/25/20 kV and 6/5 kV in their electrical networks. To determine the maintenance rates of the electrical network, the maintenance costs in relation to the length of the network were taken.

The maintenance rates ranged from €1 to €40 per meter. Table 1 (P1 to P9 stands for the different participants of the benchmarking study) shows the correction factors as horizontal axis and the key performance indicator maintenance rate as vertical axis. The regression line increased slightly with the correction factor, which was expected, as the correction factor stands for the complexity of the networks, and the increasing maintenance rates should correlate with increasing complexity.

The cost-saving potential was up to €5 per meter. Costs could be saved, for example, through an extension of the revision cycles of the electric energy networks. For transformers, most participants chose five years for revision cycles, but there were also significantly shorter and longer revision cycles. While most participants normally conduct the revisions annually, the revision cycle for transformers was extended to 10 years at one park. The revision cycles for switch bays were between four years and 10 years and for protective relays between one year and 6 years. The differences could be explained by the participants' historically different levels of experience with maintenance.

Utility Infrastructures

With high, medium and low pressure, the participants had three different steam-pressure levels. The range of maintenance rates of steam networks in relation to the length of the network was up to €28 per meter (Figure 2). The cost-saving potential was up to €5 per meter.

Cost savings are possible through condition-oriented maintenance, e.g., for pumps, generators and compressors, which enables early detection of failures as well as implementation of equipment-specific key figures (e.g., mean time between failures, mean time to repair). The maintenance rates for the production and distribution of compressed air were up to €39 per meter (Figure 3), and the cost-saving potential for maintenance was up to €15 per meter.

The maintenance costs for industrial water based on length were between €4 and €63 per meter. The cost-saving potential for maintenance costs was up to €5 per meter. Cost-saving potentials can be realized by the reduction of network losses. Within a continual optimization of water networks, some of the participants had systematically set up a network of water meters, which had led to an improvement of the identification of weak spots and leakages.

For drinking water, based on length, the maintenance rates were up to €43 per meter based on total costs. The cost-saving potential for maintenance with the correction factor was up to €8 per meter.

Traffic Infrastructures

Various key performance figures for roads were defined, such as maintenance rates based on the size of area of the roads and in relation to the replacement value. The maintenance rates for roads based on area are up to €5 per square meter and based on replacement values up to 0.1%. The road-management costs — costs mainly for the road managers to observe the road conditions and to manage maintenance activities — are between €6,000 and €40,000. The specific management costs as key performance indicator for roads based on area are up to €0.28 per square meter and the cost-saving potentials around €0.1 per square meter — or in absolute numbers €15,000 per year. For street lighting, the maintenance rates based on the number of lights are up to €100 and the maintenance rates based on the size of road up to €0.4.

Conclusions of Parts 1 and 2

The benchmarking results showed large differences in performance levels, indicating there are still significant cost-saving potentials. Each industrial park should understand the individual performance level and adapt best practices in all areas. The performance level makes a clear difference between high-performance industrial sites and sites that have to be more consequent in their restructuring and cost-saving efforts.

The benchmarking, using the correction factors, enabled the comparison of different infrastructures and made possible a discussion based on comparable and comprehensible figures. The correction factors, which have to be very specifically defined for each area, increase the acceptance and applicability of the benchmarking methodology. The correction factors used in this study worked well in the majority of cases and could also be used in other studies or function as a starting point for a discussion to customize them more to special needs.

Some values of key performance indicators were below the regression line, which means the key performance indicators are below best practice. These "negative" cost-saving potentials gave, in some cases, clear indications that the maintenance level was too low with negative consequences for the long-term competitiveness of the infrastructure. A conclusion is that not the lowest maintenance level but rather the optimal maintenance level should be the aim of best-practice and performance-improvement initiatives. This rather simple insight is sometimes lost, especially within top management, which leads to unrealistic and long-term, even counterproductive, cost-saving targets.

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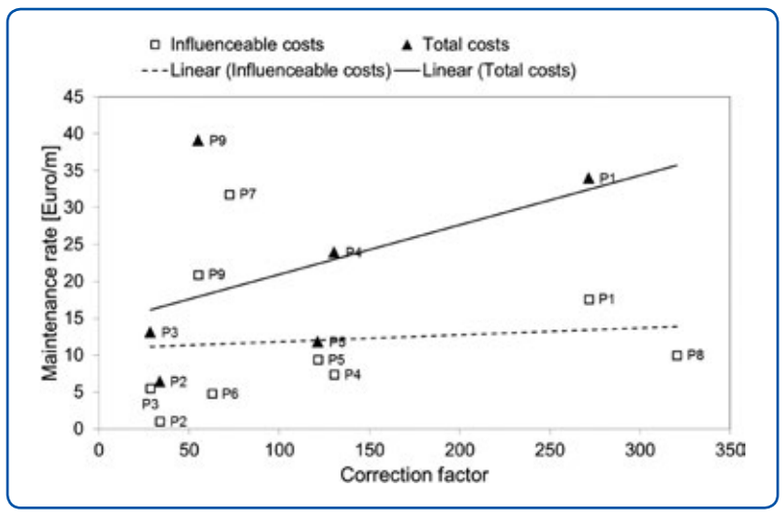

Figure 1: Maintenance rates for electrical networks based on length

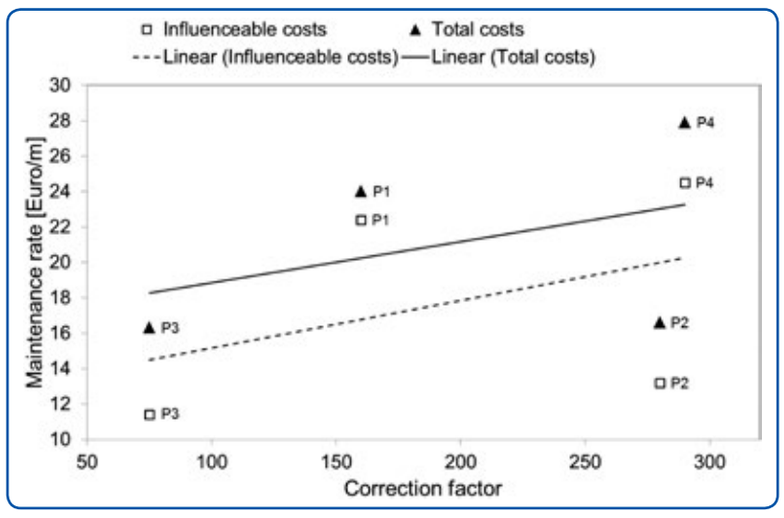

Figure 2: Maintenance rates for steam networks based on length

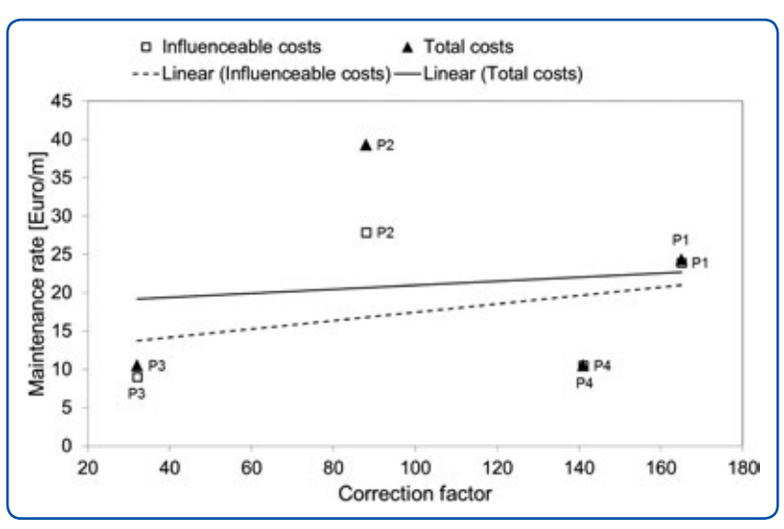

Figure 3: Maintenance rates for compressed-air networks based on length

	P1	P2	P3	P4	P5	P6
Maintenance rates (normalised building costs)						
Number of buildings	12	9	26	80	4	143
Influenceable cost [%]	1,53	0,43	0,78	0,86	0,29	1,45
Total costs [%]	1,82	1,46	1,05	1,74	0,29	1,84

Table 1: Maintenance rates for all types of buildings based on normalized building costs with number of buildings as correction factor

AkzoNobel Opens Membrane Electrolysis Plant in Germany

AkzoNobel recently inaugurated its new, highly efficient chlorine membrane electrolysis plant in the Rhein-Main area, Germany. The Frankfurt-based, state-of-the-art plant is the result of a major conversion and expansion project begun in 2011 and involving a €140 million investment by the company. Capacity has been increased by 50% whilst at the same time reducing the plant's overall ecological footprint by some 20%. "This investment in our Specialty Chemicals business highlights the steps we are taking to strengthen our market positions and further improve our performance as a company," AkzoNobel CEO Ton Büchner said. "We are constantly looking for new and innovative ways to improve our operational efficiency, drive our sustainability agenda and improve our service to customers."

Werner Fuhrmann, the company's Executive Committee member responsible for specialty chemicals added: "This plant produces building blocks for the manufacture of products we all use on a daily basis ranging from pharmaceuticals and tooth paste to door and window frames. By radically improving our efficiency and increasing our use of renewable energy, we can take significant steps in making these everyday essentials even more sustainable."

The facility has been converted to the latest generation membrane technology. Radical efficiency improvements will reduce energy consumption by 30% per ton of product. Boosting chlorine production capacity up to 250 kilotons/a will also reinforce the company's leading positions in Europe's chlor-alkali markets.

Work at Frankfurt started in 2011, with commercial production from the new plant expected to come on stream in the next few weeks. The site is one of three chlorine plants operated by AkzoNobel in Germany, the other two being located in Bitterfeld and Ibbenbüren.

Products from the salt-chlorine chain, including chlorine, caustic lye, and derivatives including MCA and chloromethanes, are essential basic chemicals and are used in countless everyday products and processes, ranging from water disinfection to clothing, amongst other things in the manufacture of epoxies, polyurethanes, polycarbonates, PVC and titanium dioxide. They are also used in the manufacture of more than two thirds of all pharmaceuticals. ■

Infobox

Part 1 of this article series described key performance indicators and cost-saving potentials of building infrastructures, for fire brigades and security services. The details of the benchmarking study can be found in scientific publications, for instance: G. Festel, M. Würmseher, Challenges and strategies for chemical/industrial parks in Europe, Journal of Business Chemistry, Vol. 10, No. 2, June 2013, pages 59-66.

Cutting Emissions While Cutting Costs

A Sustainable Solution to Environmental Plant Improvements

Multidimensional Approach

— Companies worldwide are working diligently to reduce energy use, water consumption and emissions both for cost cutting reasons and due to legislation. Global science company DuPont uses newest techniques when it comes to emission control, waste management and energy usage. The company views sustainable operations as key to long-term productivity.

„We see sustainable growth as a challenge," Paul Meyers, Site Manager, DuPont Dordrecht says. "A challenge to use resources intelligently, identify the most effective sustainability projects for our company and make the best decisions for our business and the environment in combination. We do not believe that sustainability, productivity and profitability are mutually exclusive."

Aerial view of the DuPont Dordrecht site in the Netherlands

Sustainability at DuPont Dordrecht

Among the 112 production plants operated by global science company DuPont, its Dordrecht site in the Netherlands is one of the ten largest. Spread over 55 hectares, its 880 employees and 150 permanent contractors produce polymers and fluoroproducts. The site has been ISO 14001 certified for over 10 years.

The European emissions trading system has meant Dordrecht has had to reduce emissions by 2% every year, to bring about a total reduction of 20% between 2010 and 2020.

The Sustainable Operations Concept

Developing a plan to continue to meet both European and national targets, and even improve on them, is not left up to each DuPont plant in isolation. Each site is part of a larger team that includes an energy champion for each of the 112 sites, Erik van Kempen in the case of Dordrecht. The energy champions hold monthly conference calls at European and global levels to discuss ideas and keep track of DuPont's global energy performance. They provide the business with regular dollar and power forecast savings, as well as progress reports. The target imposed by DuPont on itself is one of reducing energy costs by three per cent every year without inhibiting an increase in production.

Erik van Kempen achieves the three per cent with the help of the energy structure DuPont puts in place for every site, which is complemented by the site's environmental network. This structure has resulted in tangible changes at the Dordrecht plant. Over the last five years, the company has invested more than €15.09 million in environmental improvement projects.

Paul Meyers, site manager at DuPont Dordrecht (left) and Wim van Lieshout, CEO of HVC Groep

Total water consumption by DuPont Dordrecht since 2006*

Year	Total water consumption (m^3)	Reduction vs base year 2006 (%)
2006	2,340,810	0%
2007	2,223,152	5%
2008	2,102,108	10%
2009	1,756,380	25%
2010	1,981,571	15%
2011	1,843,626	21%
2012	1,793,490	23%
2013	1,685,606	28%

(*These figures represent de-mineralized & drinking water)

The managers of the steam saving project (from left to right): Peter van Uden, Hugo van Kempen, Erik van Kempen

Reducing Energy and CO_2 Emissions

One of the most significant energy savings projects involves a collaboration with HVC, an incinerator of community waste that is adjacent to the DuPont plant in Dordrecht. It produces steam, which the incinerator converts to electricity. HVC came to an agreement with DuPont to sell steam to the Dordrecht site on weekends. It is a clear win-win. For DuPont, it has the dual benefit of saving fossil fuels (no need to run its own two co-generators on natural gas) and saving money.

Thanks to this project, Dordrecht's CO_2 emissions will drop by roughly 50,000 tonnes of CO_2 savings per year – roughly similar to the emissions produced by approx. 15,000 medium sized cars driving an average 20,000 km per year.

"A pipe in the air may not sound very spectacular," Erik van Kempen says, "but for DuPont, our collaboration with HVC means getting a step closer to achieving one of our internal sustainability objectives: saving 11% of energy by 2015."

These internal sustainability objectives form part of a rigorous set of targets DuPont has communicated to all its employees. The company offers incentives for ideas and projects through its DuPont Production System (DPS), continuous improvement processes and through its internal awards. Dordrecht won this award in 2008 for a project that increased steam production, reduced the need to cool water and resulted in a significant annual cost saving. Behind this is the simple modification of a distillation column. Previously, the column had consumed a lot of steam. By modifying it, the production team of impact-resistant Delrin plastic was able to save 16.7 k tonnes of steam annually and win 25% of the total steam needed by the Dordrecht site in other manufacturing processes. The relatively small investment resulted in a big payback.

Dordrecht has also introduced a real time dashboard signalling system in production operations, which notifies workers when energy usage is excessive. It reminds them to switch off unnecessary pumps, for example. One of the dashboards indicates the status of 25 process values relating to energy consumption. By influencing these values, the operators of the Delrin unit have been able to save energy worth €1m annually.

As a result of many of these projects, the Dordrecht site used over 14% less energy in 2012 to produce the same number of products as in 2005.

Decreasing Water Consumption

Water recycling is another of DuPont Dordrecht's key environmental policies. Delrin, for example, has managed to cut fresh water intake by 91,000 m^3 by improving efficiency at the site's cooling tower. Paul Meyers explains: "Through the implementation of a water treatment programme and a sophisticated dosing system, we managed to reduce chloride concentration in the intake cooling water, almost doubling overall system efficiency." The water saving represents the equivalent to the average yearly water usage of 650 Dutch households.

"In addition to supporting our sustainability goals, this technology will also help us protect critical assets from corrosion, deposition and biological fouling", says Mr Meyers. "It will In addition to water reduction, the project improved safety at the site by reducing acid deliveries by truck from 130 to only 15 per year. This also has a positive impact on reducing CO_2 emissions.

Cutting Emissions and Recycling

Air emissions have generally fallen at the site over the last few years. A number of emission reducing projects have focused on hydrofluorocarbons and hydrogen fluoride. Thus, the exhaust gases from the fluoroproducts and the fluoroelastomer Viton plants have been sent to an incinerator. In this unique furnace, carbon fluorine burns waste gases at high temperatures and converts them into a useful product that is used in the toothpaste industry. A similar process is used in the Delrin part of the site, where a scrubber washes out all the substances that dissolve in water. Previously, there were minimal residual emissions into the ambient air. Now, the site has put in place a number of lines, which conduct those waste gases into an incinerator.

Other efforts, when loading and blending refrigerants, for example, have focused on improving recovery of residues using new vacuum and condensation techniques on containers returned by customers and on the increased use of leak proof connections so that fewer emissions are set free.

Sharing Sustainability Experience Globally

DuPont has found the most efficient approach to using resources sustainably requires an integrated environmental support structure for its sites. This structure ensures locations collaborate, sharing expertise and ideas, with the goals of improving productivity and environmental footprint. That in turn allows the company as a whole to benefit, making sustainability a factor in long-term productivity.

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Painting a Better Picture of Demand

AkzoNobel Turns to Terra Technology to Cut Excess Inventory and Improve Customer Service

Eliminating Inefficiency — When paint and specialty chemicals producer AkzoNobel looked to improve customer service and raise return on capital by cutting excess inventory, it turned to Terra Technology. Alain Crottaz, EMEA Planning Director at AkzoNobel, explains the business drivers behind the company's decision to implement Demand Sensing and Multi-Enterprise Inventory Optimization in Europe and Africa.

Alain Crottaz
EMEA Planning Director, AkzoNobel

"As part of a larger supply chain efficiency program, we were looking for a single solution to achieve three strategic goals: providing higher customer service, cutting excess inventory (in particular, safety stock driven by elevated forecast error), and transforming available point-of-sale (POS) data into value for AkzoNobel and its customers," Crottaz explains.

Enhancing Customer Service

AkzoNobel has a complex supply chain with more than 50,000 products within the Europe, Middle East and Africa (EMEA) paint business. "Our first challenge was to enhance customer service by improving the way we predict client demand at a more granular level," Crottaz says. Like many companies, AkzoNobel's forecasts were traditionally planned by item-group and generally in a linear fashion. "These splits add considerable error and make it more challenging to meet customer service objectives," continues Crottaz. "We wanted a way to forecast each item at each depot, eliminating the inefficiency of using splits. We also wanted a system that would help us cut extreme error which is by far the most disruptive and costly to the supply chain." Extreme error occurs when shipments exceed or fall short of forecasts by twice or more. Extreme oversell error puts service at risk potentially hurting revenue and lowers margins through expedited product shipments between depots. Extreme undersell error means excessively high inventory positions, hurting return on capital.

Cutting Inventory

"Our second goal with the new software is to improve working capital and to free cash by reducing inventory by more than 10%," says Crottaz. Lower stock also helps profitability by lowering warehouse and logistics costs with third-party suppliers.

Creating an Actionable Response

"The third objective is to transform available POS data into value for our company and customers," explains Crottaz. Daily retailer data contains valuable information on future orders. The challenge was to find a way to reliably extract this information in time to respond to market changes. Crottaz continues, "SAP's APO Demand Planning is limited to traditional forecasting methods that predict demand from prior sales, so we looked to augment the SAP engine with a solution that can use POS to sense demand and create an actionable response."

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Choosing the Right Technology

So why did AkzoNobel choose Terra? With ten years of experience at Coca-Cola, Crottaz knew that FMCG (Fast-Moving Consumer Goods) companies like Procter & Gamble successfully use POS to improve forecast accuracy and better serve retailers. "We focused on Terra because their Demand Sensing solution is the only one to have solid references from multinational companies with large, complex supply chains," says Crottaz. "Their software is used by some of the world's largest manufacturers to plan demand in more than 160 countries."

The results of a pilot program made the decision clear. Weekly forecast error for AkzoNobel's paint business in UK, France, Germany, Netherlands and Ireland was reduced by 29% for the first week of forecast. It works seamlessly with AkzoNobel's current SAP systems. Crottaz explains: "Demand Sensing sits between our SAP Demand Planning (DP) and Supply Network Planning (SNP) modules. Forecasts are sent from DP into Terra's Demand Sensing engine, along with other current demand signals from the supply chain, such as retailer POS. Terra's algorithms analyze all of this data to create the most likely prediction of future sales. Demand Sensing then publishes daily forecasts for the next 90 days directly to SNP."

The Value of Daily Information

The full value of using POS data comes from being able to make supply decisions in tune with current market realities. "Retailer data received every day contains valuable new information about changes in demand," adds Crottaz. "Daily forecasts allow us to use this information in our supply decisions and quickly respond to changes. Every night, Demand Sensing recalculates and republishes four to six weeks of daily forecasts using the latest information to create the most accurate picture of current demand." With AkzoNobel's complex network, that means creating more than 6 million unique forecasts daily. Of course, it is not possible for planners to review millions of new forecasts each night. Instead, the forecasts are published directly to SNP, making it a "touchless" system. While planners can override Demand Sensing's recommendations, the sophisticated algorithms perform best when left alone.

The Multi-Enterprise Inventory Optimization (MIO) tool is used to convert Demand Sensing's accurate daily forecasts into lower safety stock. Crottaz: "While a number of vendors offer inventory optimization solutions, we looked for a single integrated solution to address both our forecasting and inventory objectives. Terra's solutions are designed to work together at the most granular level, providing a seamless way to maximize the financial benefits of our new accurate forecasts. "

Today, Demand Sensing and MIO are being deployed throughout AkzoNobel's EMEA region and are planned to go live in early 2014, starting with two important countries for their paint business — the United Kingdom and France.

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Sustainable Profitability

Minimize Carbon Footprint and Maximize Supply-Chain Value

Good for Environment, Good for Business — Reducing energy consumption and emissions with optimal supply-chain management is a commercial necessity for many manufacturers today. Incorporating sustainability into standard strategies and policies will make the supply chain more efficient from a greenhouse gas perspective.

The carbon footprint of a process manufacturing enterprise spans the entire supply chain. Companies are now continuously analyzing their footprints to understand the influence of each segment of the supply chain. With the increased consumption of fossil fuels, more demand leads to higher prices for everyone. The threat of global warming and its effect on the environment has led to international regulations that must be factored into a company's business plan.

Regulations have led to an emissions trading market to control worldwide pollution. There are also increasing expectations from consumers, investors and other stakeholders for corporations to disclose the environmental credentials of their products or services.

"Cap and trade" is an environmental policy approach to controlling greenhouse gases with a mandatory cap on emissions while providing flexibility on sources and how they are compliant. The cap sets a limit on emissions designed to reduce the amount of pollutants released into the atmosphere. The trade creates a market for carbon allowances, helping companies to turn pollution cuts into revenue. The option to buy or sell allowances or carbon credits gives companies flexibility in meeting each year's cap.

Companies can address sustainability in fundamental ways through supply-chain optimization. With global demand for fossil fuels and prices on the increase, pursuing a sustainability initiative needs to be an integral part of a company's supply-chain strategy. For many process-industry companies, manufacturing represents the largest component of the carbon footprint because of the energy-intensive nature of the materials produced. History has shown that energy consumption as a result of global industrial material demand has consequential increases in total energy use and CO_2 emissions.

Managing the Supply-Chain Network

There are effective ways that companies can incorporate sustainability into the standard supply-chain strategy. One such way is to better manage the supply-chain network. For materials that can be made in multiple locations, AspenOne Supply Chain Management software can help companies select the optimal source location from both an economic and sustainability perspective. Long-term visibility into what needs to be produced allows companies to optimally position inventory throughout the supply-chain management network to best fulfill customer orders.

With flexibility in the network, using alternative modes of transportation could effortlessly reduce emissions while maintaining profit margins. For example, simply

Laura Rokohl
Supply Chain Manager, AspenTech

switching from relying primarily on trucks for distribution to rail cars can adhere to both your company's sustainability and profitability goals. Aspen Plant Scheduler can effortlessly create a "what if scenario" of this example, and evaluate its economic effect on your supply chain before the company commits to it.

Aspen Supply Chain Planner is a key component of AspenOne Supply Chain Management. The software enables manufacturers to increase operational efficiency through improved planning and scheduling of the production process, providing the agility to respond to dynamic market demands and opportunities. The Supply Chain Planner develops the most optimal plan taking into account labor and equipment, raw materials or feedstock, inbound/outbound transportation, storage capacity and other variables. An easy-to-use interface with streamlined workflows helps to quickly navigate through supply-chain complexity and respond faster to unexpected market conditions to profitably meet production and management goals.

The software typically determines production levels by product or family, location and time period for an intermediate time horizon up to two years. The goal is to meet expected demand in the most profitable manner while considering:

- raw material availability and price
- cost of changing production levels from one period to the next
- production costs
- transportation costs

To obtain the best production and distribution plans, each business unit needs functionality to align as closely as possible with its unique practices and priorities. With this tool, business operations from the most simple to the most complex can be modeled for optimum results, in both make-to-stock and make-to-order environments. This end-to-end supply-chain optimization solution is fast, flexible and easy-to-use.

The role of supply-chain planning software in the sales and operations planning (S&OP) process is to focus on businesswide supply and inventory planning, specifically determining "where to make what." It involves allocating production across various plants while minimizing transportation and operating costs. By considering both the production and distribution, software provides a globally optimal solution while respecting capacity and other constraints.

Issues addressed include:

- where to procure raw or intermediate materials
- sourcing of production, both across and within plants
- use of internal finite capacity versus purchases, tools, contract production, exchanges or infinite capacity
- movements of intermediates between manufacturing sites

By enabling users to quickly hone in on the information that is most useful to them, the supply-chain planning software can help planners evaluate several alternatives and determine answers that will increase profits and improve customer service, all within the context of your specific business constraints.

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Achieving Long-Term Sustainability

Significant greenhouse gas emissions reductions can be obtained from improved technologies and operations. From a planning perspective, supply-chain planning software allows companies to take advantage of any flexibility the company may have in terms of energy sources. The ability to allocate production using alternate sources of energy, such as a plant that uses hydroelectric power versus fossil fuels, can lead to a significant decrease in the carbon footprint while still optimizing the supply chain.

Those companies that have the opportunity for off-peak production will have energy rates that are substantially less than during peak hours. Factoring this into the current energy plan will make a huge difference. A key question companies should ask themselves is "How does my utility vary as a function of my production?" Supply-chain planning software can track and report utilities consumption even if it is not a constraint or basis for optimization. From a scheduling perspective, Aspen Plant Scheduler can minimize transitions and operations involving higher energy requirements, such as unit startups or shutdowns.

Key planning decisions will be influenced by greenhouse gas emissions limits. Supply-chain planning software can model these constraints and manage trade-offs. When a company can calculate what emissions will be for a certain process, then it is possible to track and report emissions against annual limits. This also provides forward visibility into potential violations. Allocating production so that companies can avoid exceeding emissions limits at a specific plant can optimize sourcing.

The economics of buying or selling allowances like carbon credits can also be incorporated into the company's plan. By optimizing the supply chain in relation to the primary sources of emissions, supply-chain planning software delivers key capabilities to help manufacturers minimize their carbon footprint while maximizing the value of the company's assets for long-term sustainability and profitability.

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Chemicals

Brazil is a land of opportunity and a growing market for the chemical industry

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Pharma

Brazil's most promising regions for pharmaceutical and biotechnological manufacturing

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Materials

At the FIFA World Cup 2014, synthetic materials provide the highest resource efficiency

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Editorial

Soccer vs. Schools

With barely a week left until the opening match of the 2014 Soccer World Cup, the host nation Brazil faces some major problems. It is not unusual for an event of that size that construction work is behind schedule, but much more serious for the international reputation of the emerging South American country are the public protests against the World Cup.

The demonstrations in many cities across Brazil were sparked by a rise in bus fares, which coincided with the massive investment in the World Cup, a slowdown in the economy and a rise in the cost of living. In a country where the minimum wage is less than €250 a month and many of the working classes face long bus commutes to cities from deprived suburbs the proposed increase would have hit the poor hardest.

When in 2007 FIFA announced the decision to make Brazil the host , the economy was booming, with annual growth of more than 5%, and a welfare program was lifting millions out of extreme poverty and the country was thriving. But as the World Cup edged closer, the economy stalled, growing by just 2.3% in 2013. Preparations for the tournament have fallen far behind schedule in some of the 12 host cities, budgets have been overrun, and transportation and infrastructure projects have been delayed or cancelled.

Events like the Soccer World Cup and the Summer Olympics, which Rio de Janeiro will host in 2016, have become obscenely expensive. The citizens of the host countries, who bear the brunt of the costs for the benefit of the few, expect that the investments will pay off for them, too – with new hospitals, schools, or public transport. The people of South America's largest country with 200 million citizens living in vastly differing circumstances were promised the dawn of a new age of prosperity that these mega-events heralded.

In the past, as a developing country, Brazil too often found itself reduced to its most famous assets: soccer, carnival, and beaches. As one of the BRIC countries, the Brazilian people now claim their share of the economic growth and the commercial boost that the World Cup is expected to trigger.

We will see whether or not the World Cup, once it started, will unite the nation and heal the cracks in Brazil's society. The Brazilian government will need to prove to its people that it takes their protests seriously and start making political decisions that will improve the living conditions, particularly of the underclass. Brazilians may give their political leaders a period of grace, but when the 2016 Olympics approach, the government will have to deliver.

Dr. Michael Reubold
Editor-in-Chief
CHEManager

Taking A Targeted Approach

Brazil: Opportunities and Challenges in Latin America's Largest Pharmaceutical Market

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Navigating the Regulatory System — Latin America continues to be an area of rising investment for the pharmaceutical industry, with Brazil and Mexico leading the way. Not only is Latin America an attractive target for potential market entrants, with the help of regulatory changes and burgeoning partnerships, it solidifies its commitment to further expanding its presence on the global pharmaceutical marketplace. Keeping pace with this expansion is increasing oversight from the Brazilian regulatory authority for domestic and foreign market entrants alike.

Brazil and Latin America as a Market

With its growing population of over 200 million people and an estimated worth of $25 billion, Brazil is the largest pharmaceutical market in Latin America. Brazil surpasses second ranked Mexico by over 80 million people and nearly double the market worth. Healthcare in Brazil is a big business with 9% of gross domestic product (GDP) going to healthcare expenditures. As these costs are increasing, governments in Latin America are emphasizing the use of generic medications and pushing for local manufacturing. Pharmaceutical production is fast becoming a substantial market in Latin American countries that can provide the infrastructure needed. For example, Mexican pharmaceutical manufacturing accounts for over 15% of the country's total manufacturing GDP.

Opportunities Through Biotechnology

Biotechnology is an area that continues to see increased investment, both for active pharmaceutical ingredient (API) and finished dose manufacture. As costs for biologic and other specialty manufactured medications continue to rise, the Brazilian government has sought to expand local manufacturing capabilities. As a means to acquire technology and augment capacity affordably, there has been a trend in deal making between companies in other emerging markets.

In mid-March, local manufacturer Cristalia Laboratories received Good Manufacturing Practices (GMP) certification from the Brazilian regulatory authority, Agência Nacional de Vigilância Sanitária (Anvisa) for three biotech APIs. The approval for trastuzumab, etanercept, and somatropin marked the first domestic company to receive Anvisa GMP certification for biotech derived products. It was achieved through a two year partnership with Alteogen in South Korea. To further develop this area, Brazilian laboratory Fiocruz has entered into a partnership with Ukrainian based Indar. Indar will transfer the technology needed for Fiocruz to manufacture insulin crystals, with the expectation that Fiocruz will be operating at scale by 2016. Additionally, fellow BRIC (Brazil, Russia, India, and China) based company Biocad announced plans last year to build a biosimilar plant in Brazil with supplemental funding being supplied by Brazil's National Bank for Economic and Social Development.

Another specialty area that has seen considerable growth is that of vaccine manufacturing. Historically, vaccine manufacture was dominated by a small number of big pharma companies, but there is a growing trend of manufacturing in emerging markets. In order to enhance local supplies as well as supplement other emerging markets stocks, companies in Brazil and Latin America have been boosting production. Recently, a partnership between the Center for Genetic Engineering and Biotechnology in Cuba and newly formed French company, Abivax, regarding vaccine research and development was announced. If successful, the Cuban developed vaccine would be marketed in Europe and other areas.

Regulated Market Presence

To date, corporate groups headquartered in Brazil have had a limited presence in highly regulated markets, like those of the US and EU. Utilizing data from Thomson Reuters Newport Premium, this presence can be better quantified. As of mid-May, active US drug master files (DMF) and European certificates of suitability (COS) held by corporate groups in Brazil account for 12 of the 49 active filings held by Latin American corporate groups in total (fig. 1). Additionally, following implementation of the Generic Drug User Fee Act, US DMFs that have been referenced in subsequent filings and have paid the fee are considered available for reference. No corporate groups based in Brazil appear on the FDA's list of DMFs available for reference as of mid-May. Mexico is the only Latin American country that has domestic corporate groups with DMFs available for reference. Evaluation of Brazil's API manufacturing presence compared to that of the other BRIC countries shows that, while its manufacturing base is far smaller than that of China or India, it has a higher number of manufacturers with some regulated market presence than Russia (fig. 2). Under Europe's Falsified Medicine Directive, Brazil is undergoing an equivalence assessment to join Australia, Japan, Switzerland, and the US on the list of third countries that will not need to submit written confirmations for exports to the EU.

Market Entry Challenges

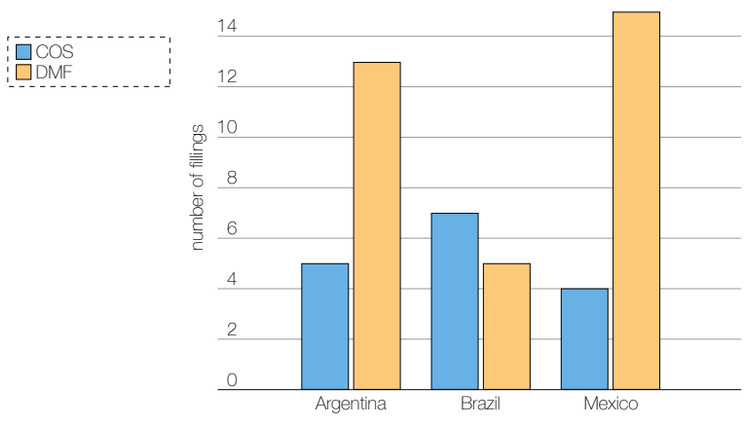
Regulations among Latin American countries vary, and gaining approval from Anvisa can take significant time, two years in most cases, with some taking up to four years. Additionally, due to a substantial backlog at Brazil's patent office, obtaining pharmaceutical patents in Brazil has been known to take up to 10 years in some cases. Further adding to the patent timelines, Brazil seemingly granted Anvisa the authority to review pharmaceutical patents for patentability requirements. This review essentially allows the health agency to veto patent applications and contradicts earlier views that such discretions were not within Anvisa's scope.

While there is a greater push towards transparency, the many layers to gaining market entry in Brazil often necessitate a local partner or presence to help facilitate approval of products. Additionally, multinational companies which have purchased local companies to gain access to the domestic market often find difficulties integrating local business practices and market needs with foreign strategy.

Takeaways

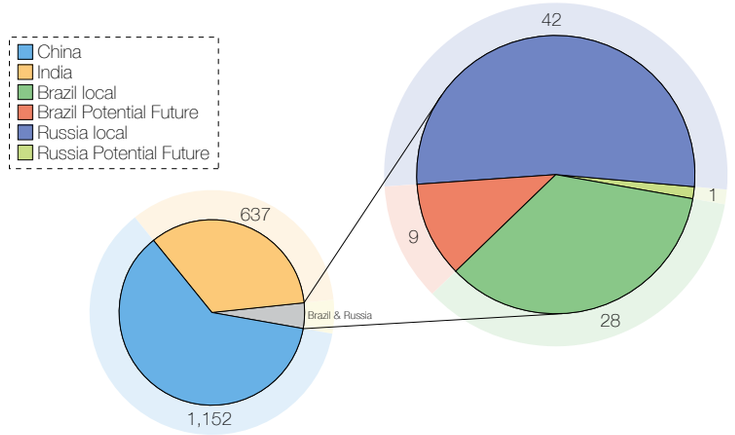
The Brazilian market is growing and offers substantial prospects for companies that are able to navigate the regulatory system to bring products into this complex country. To be successful, foreign companies will need careful evaluation of market needs and to take a targeted approach for which products to bring to market. Addressing local manufacturing deficiencies and critical need products through partnerships for biotech products and manufacturing will continue to be an important growth segment for this region. Additionally, while Latin America's regulated market presence is small, it is growing and more companies are investing in facilities and partnering for capabilities, providing ample opportunities for the future.

Active US DMFs and COS by Corporate Group Country — Fig. 1



Source: Thomson Reuters Newport Premium — © CHEManager International

Brazilian Corporate Group Ratings in BRIC context — Fig. 2



Source: Thomson Reuters Newport Premium — © CHEManager International

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Brazil is Still to Score

A Growing Chemical Market Driven By Increasing Population, Urbanization and an Expanding Middle Class

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The Right Dynamics — With a gross domestic product (GDP) of $2.2 trillion in 2013, the World Bank ranks Brazil as the world's seventh largest economy and one of the two economic powerhouses alongside Mexico in the region. Yet it has experienced a slowdown: in comparison to a GDP growth rate of 7.5% in 2010, the Brazilian economy slowed down significantly to 0.9% in 2012, the lowest of the BRICs.

This year Brazil hosts the 20th FIFA World Cup and in 2016 it will host the Summer Olympic Games. These global events were to stimulate the country's economic development - improving infrastructure, creating jobs and promoting Brazil's global image. Much of the planned investment, particularly foreign direct investments, has not occurred. Despite a fiscal stimulus in advance of October's election, GDP growth is only likely to be 2.4% this year: according to the Institute of International Finance, lackluster growth has become the norm rather than the exception.

A Growing Middle Class

A key driver of future growth and the advancement of the country's level of prosperity will be Brazil's growing middle class and its growing demand for consumer oriented goods and services. Brazil's total population is expected to grow to 233 million by 2030, a more than 20% increase from 2011 to 2030. The consumption per head is expected to increase by over 50% from 2011 to $6,300 by 2030. The South-East of the country which has 42% of the population, currently accounts for 55% of the GDP, whereas the northeast of Brazil with 28% of the inhabitants only generates 13.5% of GDP. It is expected that new growth regions will open up in the historically under-developed northeast.

Can Production Meet Demand?

Production output will follow demand impacting favorably such sectors as the construction, agriculture, consumer goods and automotive. The construction industry represents approximately 20% of industrial output in Brazil and recorded a CAGR of 13.2% from 2008 to 2012. From 2013 to 2017, a CAGR of 8.7% is expected. Another large sector, automotive, accounts for 5.5% of the country's GDP and 23% of the manufacturing output. In 2013, the automotive sector witnessed a production growth of 9.9% with growth expected to continue. The Chemical industry contributes approximately 3% of the country's total GDP and is expected to grow from a market value of $120 billion in 2013 to $160 billion in 2017, an overall CAGR of 8.3%. Although the industry with its 4500 chemical companies is well challenged to meet the increased demand, growth will nonetheless be hindered due to the expensive raw materials, lack of infrastructure, and the complexity of the legal and regulatory regime. Based on the 2014 World Bank's 'Ease of Doing Business' ranking, Brazil was ranked 116th, behind Mexico (53rd) and China (96th). For the country to grow, the government must work alongside the private sector to overcome these challenges.

The largest local chemical player in Brazil as well as in Latin America (8th worldwide) is Braskem with €18 billion sales in 2013. Major global foreign companies such as BASF, Bayer, Dow Chemicals, Solvay/Rhodia, Lanxess, and M&G Chemicals have plants in Brazil.

A Mounting Trade Deficit with No End in Sight

Although Brazil has raw materials, it is a net importer of chemicals with a record $32 billion negative trade balance in 2013. Brazil produces a limited amount of high-end specialty chemicals, less than 15% of the market value. Higher margin derivatives must be imported to meet Brazil's demand for specialty chemicals products. In 2012, commodity chemicals accounted for over 63% of the total market value of €117.5 billion with thermoplastic resins being the major export item. In light of the current growth impediments, the chemical industry trade deficit is expected to continue growing in 2014. To avoid losing further credibility as a location of choice for investment, Brazil needs to improve its infrastructure, loosen protectionist measures and streamline its administrative process.

Until it does so, the level of investment in Brazil will remain small scale. For example, although BASF plans in 2014 to invest in an acrylic acid, butyl acrylate and superabsorbents plant in Camacari for €500 million, BASF's planned capital expenditures from 2014 to 2018 for the South America, Africa and the Middle East region only accounts for 4% of its total investment funds. This 4% level pales in comparison to the 18% BASF is earmarking for the Asia Pacific region.

Brazil also faces stiff competition from the US, as result of the shale gas boom. To access competitive feedstock, local majors are investing abroad. For example, even Braskem has made some significant investments abroad including an Ethylene XXI JV project with Pemex in Mexico as well as the Appalachian project in West Virginia, US. The Appalachian project includes an ethane cracker, three polyethylene plants and associated infrastructure for water treatment and energy cogeneration.

Feedstock Challenges

Expensive Naptha-based crackers: The majority of the crackers in Brazil are primarily naphtha based, with only two capable of using restricted amounts of ethane and propane. The country also has one ethanol–to–ethylene dehydration plant. Despite having the diverse feedstock base, the country is facing cost challenges. While the industry giants are hungry for cost-advantaged feedstock, the shale gas in the north-eastern region and the pre-salt oil & natural gas discoveries have renewed hopes for the industry.

Moving Ahead With Natural Gas and Shale: The country ranks 10th in proven recoverable shale gas reserves with approximately 250 trillion cubic feet (tcf). Despite environmental pressures, Brazil's National Petroleum Agency (ANP) awarded 72 onshore natural gas and shale gas blocks, in December 2013. The outlook of this development is viewed with skepticism as the infrastructure related to pipelines and transportation that supported the US's shale gas success story is lacking in Brazil.

A Sign of Relief with Pre-Salt: The world's largest oil discoveries in recent years have come from Brazil's offshore, pre-salt basins; with total estimated recoverable oil & natural gas reserves standing at over 50 billion barrels of oil equivalent. Brazil's oil & gas giant, Petrobras, plans to invest $73 billion in pre-salt exploration and production activities from 2013 to 2017. The pre-salt development has renewed the hopes of the domestic chemical industry. Furthermore, Petrobras has agreed to supply cheap ethane from the pre-salt reserves to Braskem's cracker at its proposed site, Complexo Petroquímico do Rio de Janeiro (Comperj).

Largest Reserves of Biomass: Brazil has the largest reserves of biomass in terms of sugarcane; the country produced 589,000 tons of sugar cane during the 2012–2013 harvest season. ABIQUIM (Chemical Industry Association of Brazil) envisions that by 2020, 20% to 25% of chemical products will be derived from sugar-cane based feedstock. Moreover, the country ranks second (after the US) in terms of ethanol output and controls approximately 27% of the global fuel ethanol production. Bio-based chemicals technology is at an early stage and domestic and foreign companies are committed to develop the technology.

Since 2010, Braskem has been operating the world's first sugarcane ethanol polyethylene plant with an annual capacity of 200,000 tons in Brazil. Braskem also has other renewable feedstock-based projects in the pipeline including a 30,000–50,000 t/a bio-based polypropylene plant and development of bio-butadiene technology with Genomatica. Among foreign players, Lanxess operates a 10,000-t/y bio-based EPDM (ethylene propylene-diene) rubber plant in Brazil.

Government Moves Needed to Support Investment

The 'Growth Acceleration Program II' launched in 2010, has been riddled with delays. The program highlighted total investments of $872 billion from 2011 to 2014, including $526 billion in the areas of logistics, energy and social development. Overall, Brazil is lagging behind its Latin American neighbors in terms of fixed investment.

Shortcomings persist and the lack of infrastructure, particularly transportation roadways, remains a key concern for the industry. Transportation is largely based on trucks, making it hard and very expensive to move goods nationally given the long distances to cover. New trucking legislation has also increased delivery time and costs.

The customs clearance process is bureaucratic and costly with import taxes on some materials (to protect domestic producers). The extent and complexity of the tax system in Brazil is also onerous. The government, under pressure, has offered industry tax incentives in the areas of R&D, employment and production of raw materials. Special incentives also exist for infrastructure development of the chemical industry in the north, north-east and central-west regions (REPENEC) and for the fertilizer industry (REIF) until 2017.

The cost of money is high. Historically, Government's interest rate policy was historically set at low levels with a record low rate of 7.5% in 2012. However, high inflation eventually pressured Brazil's central bank to set higher rates to help regulate inflation.

Growth Remains Fragile

Brazil is a land of opportunity with the right dynamics – a growing market for the chemical industry driven by increasing population, urbanization and an expanding middle class. However, until Brazil comes to grip with its challenges and the government improves its policies and programs, the majority of investment will continue to flow elsewhere.

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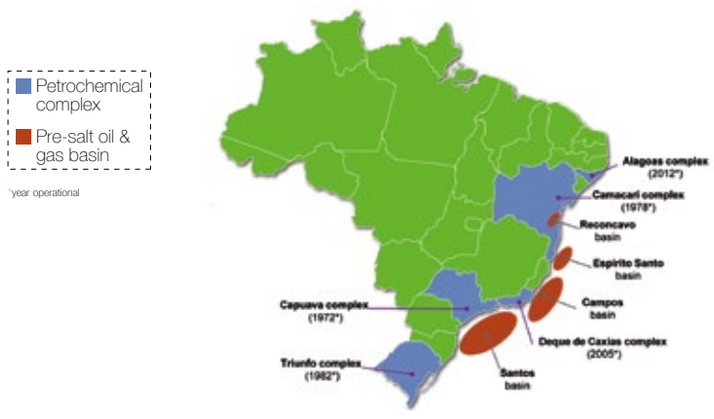
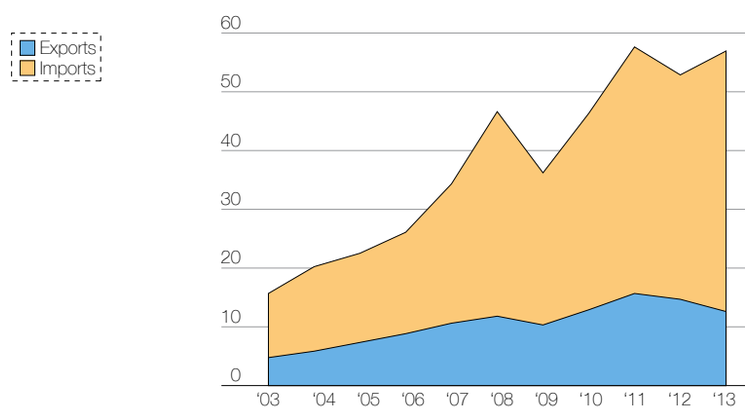
Chemical complexes in Brazil — Fig. 1



Source: Braskem website, accessed 28 April 2014; Baskem 2013 annual report; Salt Dome: Challenges And Opportunities For OCTG, The Vallourec Oil & Gas online magazine, accessed 28 April 2014

Brazilian trade balance of chemicals — Fig. 2



Source: ABIQUIM 2011
ABIQUIM press release dated 6 March 2014

Fixed investment, percent of GDP — Fig. 3

Source: IMF World Economic Outlook Database 2014

Untapped Opportunities

Brazil's Most Promising Regions for Pharma Manufacturing

Giving Pharma a Boost — Brazil's business environment is notoriously cumbersome. The manufacturing sector in particular suffers from high tax rates, poor infrastructure and increasing foreign competition. However, a more in-depth look at this sector reveals several opportunities, particularly for pharma manufacturing. And although new entrants to the market can be initially drawn to the bustling areas around São Paulo and Rio de Janeiro, other regions are now raising the interest of pharma manufacturers.

Paul Samaha
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While Brazil's lackluster manufacturing sector is one of the reasons behind the country's sluggish economic growth in 2013, pharma manufacturing actually stands out thanks to relatively high production standards and capacity. Despite these advantages, Brazil's pharma market remains largely reliant on imports, leading to a trade deficit of nearly $6 billion in 2013. Brazil's biotechnology sector is also highly dependent on imported raw material, with 86% of local biotechnology companies having to import both reagents and equipment. In 2013, pharma production reached $27 billion (chart), 39% of which is concentrated in the state of São Paulo (Southeast), notably in the metropolitan areas of São Paulo and Campinas. In parallel, the neighboring state of Rio de Janeiro accounts for 12% of total pharma production and the South for 18%. However, this heavy production concentration in the South and Southeast does not necessarily reflect drug consumption patterns among the population: in fact, more than 65% of pharma consumption takes place in other regions of Brazil. Companies are increasingly finding important economic advantages to locate their manufacturing plants outside major states, as competition for land, infrastructure and human capital has become fierce, especially in and around São Paulo.

The government's current goal is to reduce the country's pharma trade deficit and enhance the domestic drug manufacturing base. Brazil's pharma industry is being shaped by two governmental initiatives: the Growth Acceleration Program which focuses, in part, on modernizing public infrastructure, and the Greater Brazil Plan which encourages the local production of high-cost drugs and promotes public-private partnerships in the form of technology transfer to public pharma laboratories. One particular incentive provided by the Greater Brazil Plan to pharma companies is the reduction of the corporate payroll tax for social security contributions from 20% to 1-2% of a company's operating revenue. The Plan is also aimed at increasing the local presence of international pharma companies, while, at the same time, encouraging investments in the production of Active Pharmaceutical Ingredients (API) and biotechnology drugs. The Plan is also aimed at ensuring Good Manufacturing Practice (GMP) compliance among small and medium-sized pharma companies, a step that is likely to increase both their market share and export potential.

The Center & Southeast: Staying Close to the Action

The presence of a large pharmaceutical pole in the city of Anápolis in the state of Goiás (Center) has encouraged the shifting of production out of the Southeast region. About one-third of Brazil's drug production by volume takes place in the Anápolis pharmaceutical pole, which is home to more than 20 pharma companies mainly focusing on generic drug production. The strategic location of Goiás facilitates the distribution of products to the São Paulo and Rio de Janeiro areas, and the Anápolis pole itself is expected to become Brazil's largest center for generic drug manufacturing. Goiás offers reduced manufacturing costs for companies by financing up to 73% of Brazil's much-debated Tax on Circulation of Goods and Services (ICMS). Currently, the largest generic drug manufacturer in Anápolis is Brazilian company Teuto, of which Pfizer has 40% ownership. Teuto's facility is the largest factory of injectable drugs in Brazil, with a production of 18 million units per month. In 2013, Brazilian giant Hypermarcas inaugurated its Brainfarma industrial complex in Anápolis, which will specialize in generic and biosimilar drug production, and will produce about 40 million drug units per month.

To the west of Goiás is the state of Minas Gerais (Southeast) which houses the Belo Horizonte Technological Park (BH-TEC), one of the largest biotechnology parks in South America. While initially catering to small biotechnology companies, the park is now increasingly attracting larger companies thanks to tax incentives and extensive university-industry partnerships. Local biotechnology company Biomm is investing $139 million in BH-TEC, in what will be Brazil's first insulin and therapeutic protein manufacturing plant. Cluster activities are also emerging in other cities of Minas Gerais, notably Uberlândia, Uberaba (both in Western Minas Gerais), and Montes Claros (Northern Minas Gerais), the latter being home to Danish Novo Nordisk's insulin production plant. Additionally, the city of Pouso Alegre (Southern Minas Gerais) is now witnessing significant growth in its pharma industry due, in part, to its geographic proximity to both São Paulo and Rio de Janeiro. In 2013, local company União Química invested $4 million in the production of biotechnology drugs while its counterpart, Grupo Cimed, is looking to increase its production capacity at Pouso Alegre by 40% in 2014. Indian ACG Worldwide, a major global manufacturer of solid drug capsules, is also establishing a plant in Pouso Alegre for the production of gelatin capsules, barrier films, and packaging equipment. This step is expected to greatly benefit the pharma industry in Minas Gerais, as the state will be able to rely on an internal supplier of raw material.

The Northeast: Embracing the Biotechnology Wave

Other previously neglected regions of the country are now increasingly attracting pharma companies. The Northeast, which currently represents only 10% of pharma production, is expected to become Brazil's new biotechnology hub, as several companies are establishing a presence there. The city of Eusébio in the state of Ceará has recently inaugurated its 50-hectare Ceará Industrial and Technological Health Pole (PITS) which promotes innovative drug production as well as collaboration between universities and the private sector. Companies settling in PITS receive special incentives such as a rebate of up to 99% of the ICMS tax. PITS will host the Institute of Technology in Immunobiology (Bio-Manguinhos/Fiocruz), the first vaccine production plant of the public foundation Fiocruz to be located outside the state of Rio de Janeiro.

The city of Goiana located in the state of Pernambuco in the Northeast is also home to an extensive 345-hectare pharmaco-chemical pole for biotechnology. Companies establishing a presence in the pole are also benefiting from its proximity to Recife, the fifth most populous metropolitan area in Brazil. The pole currently has six manufacturing plants which are under construction, notably Swiss Novartis' $300 million meningitis vaccine production plant. In parallel, Brazilian Lafepe, a public laboratory owned by Pernambuco, will be producing antiretrovirals, while local company Riff Laboratório Farmacêutico will be producing blood serum. Hemobrás, a new federal-owned laboratory, is investing $284 million for its hemotherapeutic drug manufacturing plant and is partnering with the national French Laboratory for Fractionation and Biotechnology for technology transfer.

Manaus: the Amazon Unlocks its Potential

The largest city in the Northwest, Manaus (in the state of Amazonas), is in turn encouraging the settlement of pharma companies in its Free Trade Zone (FTZ). The Manaus FTZ, which is already home to several industries, is particularly attractive due to an 88% reduction on import tax for raw material, a 75% reduction on federal income tax, and reductions of 55% to 100% in state value-added tax, among other incentives. Leading Brazilian company EMS Pharma is establishing a manufacturing plant in Manaus for its subsidiary Novamed, which will focus on the production of solid drugs. EMS Pharma, which will invest $162 million and employ about 400 people, is the very first pharma company to settle in the Manaus Industrial Pole of the FTZ, and several other pharma companies are expected to follow suit in the near future. EMS Pharma's move was driven by the government's approval in 2012 of the Basic Productive Process for solid drugs, which is the minimum set of operations needed for the industrialization of a product in the Manaus FTZ in order to qualify for tax incentives. EMS Pharma has also sealed a research and development partnership with the Amazonian Biotechnology Center of the FTZ, which conducts research on profitable biotechnology drugs using resources of the Amazon rainforest.

While still hampered by bureaucracy and relatively high tax rates, Brazil's pharma manufacturing sector is being significantly transformed thanks to governmental initiatives and increasing public and private investments. These activities, which are starting to reshape the local pharma manufacturing map, will likely boost Brazil's drug industry even further and consolidate the country's position as a regional and global leader.

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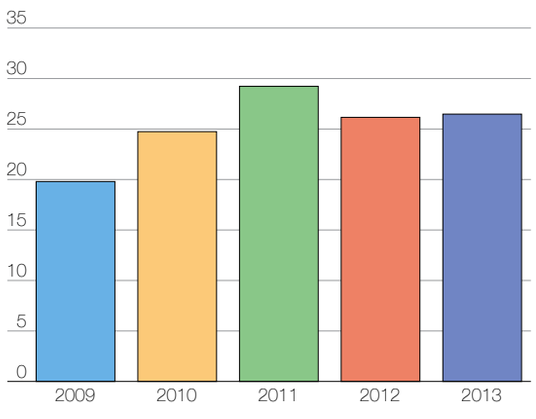
This article is based on STEM-Pharma's report "2014 Pharmaceutical Growth Opportunities in Brazil".

Brazil's production of pharmaceuticals & medicinal chemicals



Source: Euromonitor International/UN/OCED (2014) © CHEManager International

Chem Cre Cham

In and Around Soccer Synthetic Materials are

Team Jerseys

Introduced for the first time at the World Cup 2010 in South Africa by Nike, now also German sports goods producers Adidas and Puma — which together with Nike equip 26 out of 32 attending national teams —are manufacturing team apparel made of PET from recycled bottles. Reclaimed, discarded plastic bottles are melted down to produce new yarn and converted into a microfiber fabric to create high performance apparel. This process saves raw materials and reduces energy consumption by an estimated 30% compared to manufacturing virgin polyester. National team kits are made using an average of 13 recycled plastic bottles per kit: shorts fabric is made with 100% recycled polyester, and jersey fabric is made with approximately 96% recycled polyester.

© Nike

Stadium Seating

A long-life performance and a high fire resistance are the label of sustainable stadium seats. These attributes are ensured by specific chemical additives. The obligation to sustainability increases the importance of a further material aspect: Recycled and bio-based synthetics are to be included in the seat production. That is why PET seat paneling made of recycled soft drink bottles and sugar-based polyolefin improve the stadium's ecological balance. Polyamide is also a material of choice for stadium seats. This versatile engineering plastic is used to replace the metal stands conventionally found in seats at stadiums. Key advantages of this plastic are its strength and durability under static and dynamic loading. The stands also have good weathering and UV resistance

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Stadiums

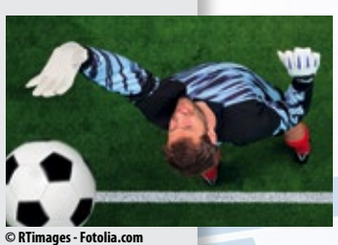
Modern materials create exciting venues for soccer matches — such as the now modernized famous Estádio Maracanã in Rio de Janeiro. Originally a venue for 200,000 soccer enthusiasts, the existing stadium was updated to meet the requirements for the 2014 FIFA World Cup. To maintain the appearance of the original stadium the roof structure was to be kept low at the inner and outer rim, and the shaped roof was meant to be floating just above the stadium bowl. The scheme designed by German architecture company Schlaich Bergermann & Partner is based on the design principle of a spoked wheel. The old cantilever roof was replaced by a new larger roof that rests on the existing building supports and is now covered with a PTFE-coated fiberglass membrane.

© Schlaich Bergermann & Partner, Marcus Bredt

The famous Maracana stadium in Rio de Janeiro will host finale of the FIFA World Cup 2014 on 13 July.

Information Technology

Information and communication technology (ICT) is all around us and we take it for granted to watch live broadcasts of every match of the World Cup on our TV screens and chat about them real-time on our computers or our smartphones. ICT devices would not exist without electronic chemicals and polymer materials. And for the first time in history ICT is not only bringing the soccer world championship to the sports enthusiasts' homes, but ICT plays a major part in the sport itself. Goal-line technology - a method used to determine when the ball has completely crossed the goal line with the assistance of electronic devices - will support the referees in their decision-making. And yet again, chemistry is the science that enables this technology.



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nistry ates npions

Key to Outstanding Design and Performance

© Schlaich Bergermann und Partner, Marcus Bredt

Match Ball

© Adidas

Brazuca — the ball everything will turn around at the FIFA World Cup 2014 — is a high-tech development from the chemical industry. The colorful product is entirely based on specialty materials. The ball's polyurethane cover is made of five layers, which ensure that the ball returns to its original shape after a shot. They also make the surface, which is now comprised of only six panels that are seamlessly welded together, particularly durable and elastic. Thanks to the synthetic material, water absorption is also reduced. Design and production with the most modern methods of the synthetic technology lead to a ball with outstanding playing behavior, such as its aerodynamics, shooting characteristics and ball control.

Soccer Shoes

© Nike

The most important equipment of soccer players, their shoes, seem to have experienced an almost revolutionary change. The lately often praised kangaroo leather, in order to build a super light and premium quality shoe, has to yield to high-performance fibers from which the shoes will be knitted like socks. The knitted, sock-like upper part of such boots is firmly attached to a light and thin high-performance synthetic sole. High-quality polyurethane elastomers cushion the impact load at cap and heel. The new shoe generation with reduced weight offers increased wearing comfort, improved ball control and even higher protection against injuries. The interaction of material and design accomplishes a combination of high strength and flexibility.

Coatings

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Weather conditions have to be taken into consideration when choosing materials for outdoor venues like stadiums. Where construction materials cannot be protected directly by additives, to avoid corrosion and its consequences, coatings will take over this task. Most stadiums these days require real technical solutions, not just a coat of paint. Most owners now expect a coating system that offers a lifetime of at least 30 years and can last with only a minimum of maintenance. Products used include primers for the structural steel or polyurethane finishes, which give the material durability and long-term recoatability. Doped with pigments or dyestuffs, they back up the design and improve the overall impression.

Playing Field

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Another innovation including synthetics provides the urgently required increase of turf durability. The advantages of the robust, but — concerning the players — unpopular, artificial turf are combined with the natural grass's convenient playing condition in a hybrid system. A very large number of artificial turf fibers, generally made of polyethylene colored with green pigments, are implanted in such a way that the grass roots grow together with the artificial fibers. It results in the basis of a robust high-tech field that can be played at least three times as often as common sports fields. Chemical additives, in particular antioxidants and light stabilizers, fulfill an important function in order to avoid corrosion and fading.

Turn the page to read in more detail about the applications presented here.

In the Name of Sustainability

At the FIFA World Cup 2014 in Brazil Synthetic Materials Provide the Highest Resource Efficiency

Controversy And Competition — The Soccer World Cup from June 12 to July 13 in Brazil will captivate millions of people. However, such a big event is not without controversy. Critics attack the event with terms like environmental destruction and waste of energy and regard it as no longer reasonable. We recently saw the same discussion surrounding the Olympic Winter Games in Sochi, Russia.

Therefore the world football association FIFA and the local Brazilian organizing committee made an effort from the very beginning to arrange a green and sustainable World Cup and, with appropriate measures, take the wind out of the critics' sails.

Here are just a few examples:

- "Green" venues: Many stadiums were LEED-certified according to the criteria of the U.S. Green Building Council. The American LEED model is an internationally recognized certification system; the acronym stands for Leadership in Energy and Environmental Design.
- Waste management: A newly established waste-management system ensures a minimization of waste and the highest recycling rate possible.
- Resource conservation: The efficiency of energy and water will be improved compared with former tournaments, as will the CO_2 emission, or carbon footprint. In addition, renewable energy and bio-based materials are favored.
- Success control: Finally, a large-scale report about effect and success of the measures will give account.

Plastics: Important Carrier of Sustainability

The implementation of these general statements will be found in many places, e.g., in the stadium's construction, the interior design, but also in the players' equipment. We find a broad range of innovations regarding improved efficiency, increased performance and sustainability — developed by the synthetics industry worldwide. Here are some related examples:

Dr. Winfried Wunderlich

Construction Elements

Since the sensational pavilion roof construction out of Plexiglas from Röhm (today part of Evonik) at the Olympic Stadium in Munich, synthetics are well-established as building materials in stadium constructions. Their use can be distinguished in two ways. Firstly, a steel construction can be equipped with flat or structured polycarbonate plates, like the Makrolon from Bayer MaterialScience or Lexan from SABIC Innovative Plastics. Secondly, a tentlike construction can use synthetic-coated glass or polyester fabric for roofs and facades. The synthetics of choice are PTFE (3M/Dyneon) and PVC (SolVin). That way the Brazilian stadium icon Maracana got a PTFE membrane roof with a 40,000-square-meter surface. In the Estádio Nacional in the capital city Brasilia, the spectators will be sun- and rain-protected by a transparent plate of Makrolon.

Artificial Turf

Another innovation including synthetics provides the urgently required increase of turf durability. The advantages of the robust, but — concerning the players — unpopular, artificial turf are combined with the natural grass's convenient playing condition in a hybrid system. A very large number of artificial turf fibers, generally made of polyethylene (PE), are implanted in such a way that the grass roots grow together with the artificial fibers. It results in the basis of a robust high-tech field that can be played at least three times as often as common sports fields.

In this application, the long-term stability of the deployed synthetics, the preservation of the mechanical strength as well as the color and shape stability are conditions for a sustainable employment. Additives, in particular antioxidants and light stabilizers, fulfill an important function in order to avoid corrosion and fading. Such high-performance stabilizers have been developed and optimized for this application area by BASF, for instance.

Stadium Seats

A long-life performance and a high fire resistance are the label of sustainable stadium seats. These attributes are ensured by specific additives as offered by specialists like BASF and Clariant. The obligation to sustainability increases the importance of a further material aspect: Recycled and bio- based synthetics are to be included in the seat production. That is why PET seat paneling made of recycled Coca-Cola bottles and sugar-based polyolefin by Braskem improve the stadium's ecological balance.

© Adidas

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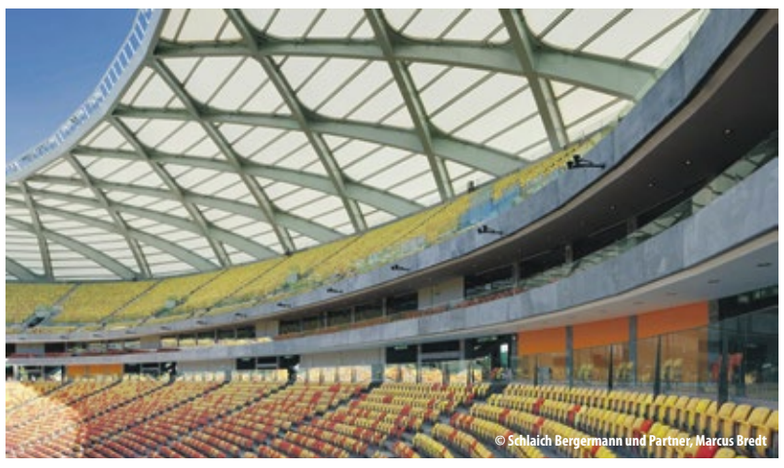


© Schlaich Bergermann und Partner, Marcus Bredt

Coatings

Like the seats, the whole construction of the stadium is exposed to extreme weather conditions. Where the material cannot be protected directly by additives, to avoid corrosion and its consequences, coatings will take over this task. They as well will be custom-made according to the load. Doped with pigments or dyestuffs, they back up the design and improve the overall impression. AkzoNobel, leading in the development and application of innovative coatings, is in demand for the FIFA World Cup stadiums as well.

Superior Gear

Soccer fans all over the world can barely await the World Cup and hope for thrilling matches. A soccer game's quality as well as the players' health significantly depends, among other things, on the personal gear. The major piece of equipment — the ball — also affects the game. In this area, too, elements of sustainability and increase in performance are based on innovations with synthetics.

Jerseys Made of PET Recycling

All the teams will be equipped with jerseys made of PET from a basic material derived from recycled Coca-Cola bottles. Processed to high-tech microfibers, the old bottles provide a fabric that, even in hot and humid Brazil, give the wearer the feeling of a pleasant microclimate. The manufacturers Adidas, Nike and Puma, which equip 26 out of 32 attending national teams, rely on this kind of material, developed in the synthetics-industry labs.

Dr. Michael Reubold

Knitting — the Latest Trend for Soccer Shoes

The most important tool of a player, shoes, seems to have experienced an almost revolutionary change. The lately often used and praised kangaroo leather, in order to build a super light and premium quality shoe, has to yield to high-performance fibers from which the shoes will be knitted like socks. Adidas and Nike simultaneously brought two similar developments on the market. The knitted, socklike upper part is firmly attached to a light and thin high-performance synthetic sole. Known materials such as Pebax by Arkema or Tepex, an innovative fiber composite by Lanxess, are used for the shoe soles. High-quality polyurethane elastomers like Adiprene (Chemtura) cushion the impact load at cap and heel.

The new shoe generation with reduced weight offers increased wearing comfort, improved ball control and even higher protection against injuries. The interaction of material and design accomplishes a combination of high strength and flexibility.

Brazuca — A Technology Dream

Last but not least, Brazuca — the ball everything will turn around at the FIFA World Cup 2014 — is a high-tech development from the chemical industry, in particular by its client Adidas. Since 1986, the FIFA World Cup balls have not been manufactured from leather but from high-quality polyurethane. For every World Cup, a new optimized ball, initially certified by the renowned Swiss testing institute EMPA, is released.

Consisting of several PU segments that are seamlessly welded together, Brazuca has a constant circumference of 69 centimeters and weighs exactly 437 grams. Both measurements are regulated by FIFA. Design and production with the most modern methods of the synthetic technology lead to a football with outstanding playing behavior, such as its aerodynamics, shooting characteristics and ball control. A surface finishing prevents any water absorption.

Goal-line Technology — the Referee's Little Helper

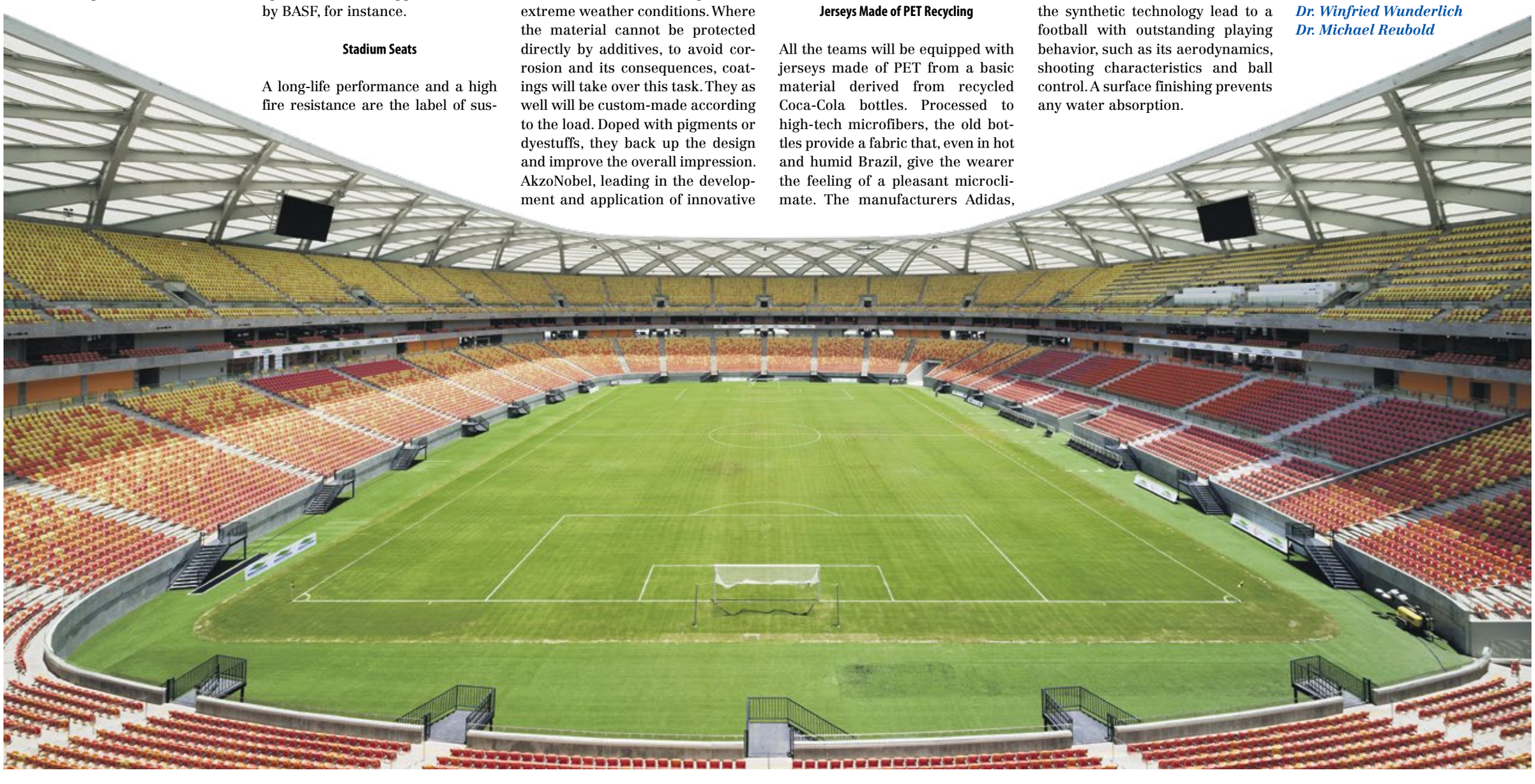
Since to err is human, in soccer – as in any other speedy sports played with balls – disputed decisions of the referees are a daily occurrence. Therefore, the FIFA decided to use – for the first time in the history of the soccer world championship tournaments - goal-line technology at the World Cup in Brazil to support the officials in their decision-making. Goal-line technology is a method used to determine when the ball has completely crossed the goal line with the assistance of electronic devices. A German company, GoalControl, has been awarded the contract to provide the equipment at the FIFA World Cup 2014. GoalControl-4D is based on 14 high speed cameras mounted on the stadium roofs/catwalks at all 12 venues in Brazil. The system captures the three dimensional position of the ball with very high precision in the air and on the pitch. When the ball passes the goal line, all referees receive a vibration and optical signal at their watches. It is beyond question that electronics used in all communication and information technology would not work without synthetic high-tech materials and specialty chemicals. From the stadiums' electronic scoreboards to the TV cameras to the flat screen TVs in our homes and the video walls at the numerous public viewing events around the world – chemistry is the science that enables the electronic devices industry.

What Would Soccer Be Like Without Synthetics?

This brief look at the FIFA World Cup 2014 from a materials' perspective leads to two particular realizations about the significance and value of synthetics in our everyday life: With the help of synthetics we often find solutions in order to get increased efficiency and a higher quality of life. At the same time, the solutions offer the highest potential for sustainable use of resources.

Soccer, and most other sports, would be at least more exhausting, often more tedious and without question harmful to the sustainable development of our society. And no matter which team will win the World Cup 2014 in Brazil, chemistry will be involved in every goal scored.

Dr. Winfried Wunderlich
Dr. Michael Reubold



The Power Of Innovation

Users Conference on Process Automation with Focus on Technologies, Solutions and Networking

Improving Efficiency — Achieving safe, reliable, profitable operations and networking with fellow users, industry and business leaders — these will be part of Yokogawa's Users Conference in Berlin from July 2 to 4. Dr. Volker Oestreich spoke in advance of the event with Herman van den Berg, president, Yokogawa Europe, about current trends in process automation.

Herman van den Berg, president, Yokogawa Europe

CHEManager International: Mr. van den Berg, terms such as cyber-physical systems —CPS, Internet of Things — IoT, or Industry 4.0 are present today at every event concerning industrial production and process automation. What do you see as the current challenges for the process-engineering industry?

Herman van den Berg: CPS, IoT and Industry 4.0 are all driving towards integrated, real-time data for visualization, simulation and design data from specification to validation. Current technology does not solve all the challenges presented by these holistic approaches, yet. However many solutions do exist in our industry, like CAE — computer-aided engineering, dynamic simulations, wireless solutions and others. What today still is missing are general solutions with well-defined and open interfaces.

The challenge with these concepts is that we have customers working in real life and dangerous environments. We have to be very sure that the implementation of new technology is done in a safe and secure manner, and we must know how to adopt own work flows and processes to accommodate these complex systems.

IT does not always see these existing risks and handle them properly. We need a high consciousness from the design state up to operations. Once more: We live in a real world, a hazardous world; our solutions must include safety solutions to prevent accidents — even dramatic accidents.

The increasing amount of information and Internet technologies brings both chances and risks. With the experiences of Stuxnet and Duqu; and the activities of NSA — U.S. National Security Agency — and GCHQ — U.K.'s Government Communications Headquarters — in mind: Are users in the chemical or pharmaceutical industries or in oil and gas really interested to apply these new technologies, being aware of the risks?

Herman van den Berg: Agreed, these new technologies bring opportunities but also risk. Our customers are not early adopters due to their safety obligations. However, when we can demonstrate consistent and safe application of technology, our users are not only interested but also have proven to invest in it.

The practice today is that vulnerability reports are published publically where customers can gauge their mind. Yokogawa reacts to these reports and provides patches, etc., to limit the customer risk.

The focus on IT security in production is much higher than in IT — you cannot only lose some data or a server, but you can lose production and the health of employees. Yokogawa is taking this challenge very seriously. So you cannot just apply technology because it is new and great, but it has to be proven — also under security aspects.

But users also live in a competitive world, and this forces them to become more efficient — and therefore they are interested in finding better, more efficient solutions. There is a balance in being more efficient but using only mature, proven technologies.

> ***Our customers live in a competitive world, and this forces them to become more efficient.***

Being aware of the risks: Do users in process automation really profit from these new technologies and where are the benefits and values?

Herman van den Berg: The benefits are of course in the efficiency of once-only-data-capture, integrated systems, adaptability, resource efficiency, etc. on the engineering side. In the operations side, the availability of data for servicing, asset management, and production management information to ensure operational efficiency is clear.

What role does the upcoming Yokogawa Users Conference in Berlin, "The Power of Innovation," have within this process?

Herman van den Berg: The Users Conference is about showing new technology implementations between users. The Steering Committee of the Users Conference consists of people from Shell, BP, Evonik, UNIS and Kisuma. They are determining the agenda for the event for maximum user value. A number of customers will be presenting how they implement solutions and indicate the benefits. This is also where customers can share experiences with Yokogawa between each other.

One of the highlights I am looking for during our Users Conference: One of our customers will be presenting efficiencies through augmented reality — they really use it and will share their experiences with the other participants. Another important topic is savings through energy management.

So the program of the conference is not pushed by Yokogawa but driven by the customers to share experiences in process instrumentation and control — of course, we want to share experiences with our customers, too. Ideas and suggestions will be input to our R&D department to be considered for future development — that is what we call collaboration with our customers.

Senior management from Yokogawa Japan will be present during the conference to offer the opportunity for high-level networking.

Can you be more specific on the topic "Instrumentation and Control" — which today, besides controlling the process including safety functions, also contributes to the efficient use of resources — often in combination with MES or PLM systems?

Herman van den Berg: The efficient use of resources is a very clear focus of our Exaquantum product family; operational efficiency is the first of five efficiency focus areas. Energy management, production management, safety management and alarm management contribute to provide our customers with a clear overview and ability to value add decision-making.

During the Users Conference, more detail will be provided about the announced enhancements of our Centum VP Distributed Control System. Yokogawa's system platforms combined with proven execution experience provide the highest quality and innovative solutions for secure and optimized process automation and management. Our global customer-centric focus together with strong local support reduces users' business risks and provides the lowest total cost of ownership. With a long history of progressive compatibility, Yokogawa is a dependable automation partner.

By the way, next year — in 2015 — we will not only have the 40th anniversary of Centum DCS but also the 100th anniversary of our company.

Regulation takes over a significant role in a number of areas in process industry — e.g., in pharma and food. How do you help your customers to handle the additional complexity associated?

Herman van den Berg: Yokogawa already has a long experience in the pharmaceutical industry, with the first — i.e., in the year 2001 — paperless recorder in the market that complies with the American FDA 21 CFR part 11 regulation.

At the time, we helped our customers to interpret this FDA regulation in seminars and provided validation services based on GAMP — Good Automated Manufacturing Practice — 4. Our work procedures — Project Lifecycle — were adapted to accommodate this need and ensure smooth project implementation. Now we provide GAMP 5 trainings to our customers.

Based on the same philosophy, we established also food — USDA, aerospace — NADCAP, and nuclear — KTA, Emphasis — products, solutions and services.

We help our customers by cooperating with them in a synergetic way, together developing solutions. We have a strong understanding of the regulation procedures, making trainings for customers — so we can help especially those companies who are new in this field.

Another important topic, especially for plants located in Central Europe, is the subject of energy efficiency. How do you support your customers with regard to this?

Herman van den Berg: I mentioned before that this would be part of the program of our User Conference. This year's program offers a host of opportunities to learn more about Yokogawa solutions and how they can assist in achieving safe, reliable, profitable operations. The program committee has put together an exciting program to learn about industry best practices and integrated solutions for a sustainable future and to discover ways to increase quality and efficiency and lower operating costs through proven methods and use of Yokogawa products.

Many of our products and solutions contribute to energy savings. By implementing Exaquantum solutions for energy management, lower energy consumption and optimization can be established. For larger plants, we provide complete energy management solutions together with Soteica Visual MESA. So, indeed, we can offer solutions for energy efficiency in all levels.

▶ Contact:
www.yokogawa.com/eu/uc

Asian Consortium to Build Complex in Turkmenistan

A consortium of Toyo, Hyundai and LG International has won a contract to build a large gas chemical complex for Turkish state-owned company Turkmengas at Kianly, in the Balkan region. The complex, set to go on stream in 2018, will produce 386,000 t/y of PE and 81,000 t/y of PP from natural gas. The gas separation unit will use Toyo's "Coreflux" technology to recover ethane and LPG, and BASF's OASE technology for acid gas removal, Lummus' technology for ethylene production, and a process earned by W.R. Grace for polypropylene. Polymer products produced at the complex will be exported and sold mainly in Asia, the EU and Turkey. (dw) ■

Idemitsu Kosan and Mitsui Cancel US LAO Project

Korea's Idemitsu Kosan and Japanese partner Mitsui have canceled preliminary plans for a 50:50 linear alpha olefins (LAO) joint venture in the US, effectively pulling the rug from underneath Dow Chemical. No reason was given for cancellation of the project announced in March 2013.At the time, the two Asian petrochemical producers said they were studying a project to build a 330,000 t/y LAO plant to take advantage of low cost ethylene feedstock at Dow's Freeport, Texas site by 2016, with Dow providing long-term supply from its Gulf Coast grid. Despite the termination, Dow said its "strategic growth investments on the Gulf Coast remain on track," (dw) ■

Preparing for Tomorrow's Pharmaceutical Challenges

Part 2: Quality by Design and Process Analytical Technology

Quality by Design — The pharmerging markets will still be extending their progress by 10 to 13%, — as population increases and rising incomes contribute to dramatically higher use of medicines. Improved access to drugs is supported by economic expansion, significant demographic and epidemiologic changes, and a broad range of government and private healthcare policies.

New legislation, expiring patents and increasing healthcare costs call for decisive changes in the global pharmaceutical industry. New markets for specialty medicines, biopharmaceuticals and biosimilars are opening up, entailing opportunities for further growth. The coming years will see markets across the globe implement new best practices and manufacturing concepts. What they all have in common is the need for safe, high-quality and consistent operations.

The use of high-potency pharmaceuticals has grown extensively, causing manufacturers to pay more heed to protecting all elements of the supply chain from their potentially harmful effects.

Continuously Containing Highly Potent Substances

In parallel to the aseptic filling of liquid pharmaceuticals, manufacturers of solid dosage forms have also recognized the need for containment solutions. They prevent

> *Pharmaceutical manufacturers are facing challenges to implement the respective regulations within the given timeframe.*
>
> Dr. Johannes Rauschnabel, Bosch Packaging Technology

biological agents from escaping either into the working surroundings or the external environment, thus protecting operators from potent pharmaceutical compounds. Containment systems require closed containers or biological cabinets, and the use of rooms with specially designed air handling and secure operating procedures. Some drug manufacturers have already built entire containment facilities, where building and equipment are optimally fine-tuned to one another. Involving the equipment supplier at an early planning stage ensures flexible, modular and space-saving solutions.

A concept that greatly benefits this approach is continuous processing. Adopted many years ago by other industries like food and chemicals, the pharmaceutical industry only recently started to apprehend the benefits in terms of cost, time, space, and material savings. As opposed to batch manufacturing, continuous processing implies manufacturing and processing materials without interruption. This concept will only work if it is based on a thorough understanding of the process interaction between the different unit operations. As Dr. Janet Woodcock, Director of CDER (Center for Drug Evaluation and Research) at FDA, pointed out at the AAPS annual meeting in 2011: "Right now, manufacturing experts from the 1950s would easily recognize the pharmaceutical manufacturing processes of today." Yet the climate has changed in recent years, and leading manufacturers are developing new technologies which focus on reduced costs and improved efficiency.

Building Quality into Products

The FDA strongly advocates continuous processing and has pointed out frequently that the approach is consistent with the agency's Quality by Design (QbD) efforts. QbD is "a science- and risk-based approach to pharmaceutical development and manufacturing […] to help ensure product quality." It aims at defining the quality and efficiency of a product before it is manufactured. Based on these requirements, product quality can be measured and controlled at different stages during the manufacturing process, while taking into account the impact of product and process properties on the final product. With a comprehensive control strategy for material, process and end product, QbD leads to reduced product loss, less production fluctuations and faster time-to-market. The QbD concept is also starting to be applied to biological products such as vaccines. However, the approach

for solid formulations cannot simply be transferred to biological products. It still requires more experience and examples to establish suitable review and inspection paradigms.

Process Analytical Technology (PAT), "a system for designing, analyzing, and controlling manufacturing through timely measurement of critical quality and performance attributes of raw and in-process materials and processes, with the goal of ensuring final product quality", is considered an integral part of QbD. When the FDA issued its PAT guidance in 2004, it triggered the development of entirely new technologies for the in-line elimination of variable product quality. Novel inspection devices, for instance for capsules, simultaneously inspect all quality features like weight, foreign particles and length in real-time and at high throughput rates. On-line checkweighers ensure in-process weight control and deliver exact weights to the filling system for adjustment of fill parameters. Software development and new imaging capabilities further contribute to a rapid advance of these technologies.

Serializing, Aggregating and Authenticating

Once all products have been safely manufactured, filled and inspected, they require one further step before they are brought on the market. Secondary packaging and end-of-line equipment plays a major role in ensuring pharmaceutical safety. Growing Internet sales volumes, production outsourcing and more complex supply chains unfortunately provide numerous opportunities for counterfeit pharmaceuticals to enter the market. Many countries are currently developing and implementing new guidance and legislation to secure pharmaceutical products along the supply chain, for instance China, Argentina and Brazil, whose health surveillance agency Anvisa adopted a new resolution in December 2013.

The „Drug Quality and Security Act" qualifies the FDA to implement a standard numerical identification (SNI) code for the packaging of all prescription drugs in a step-by-step approach beginning in 2015. The Turkish Pharmaceutical Track & Trace System (ITS) even mandates the serialization of all OTC (over-the-counter) and prescription drugs on a unit level from production to patient. The European Union's Directive 2011/62/EU (Falsified Medicines Directive) also stipulates the implementation of uniquely coded, serialized packs for almost all prescription drugs. At the same time, the EU demands a second layer of security – tamper-proof closures. They clearly indicate whether a package has been previously opened or tampered with. Pharmaceutical manufacturers are facing enormous challenges to implement the respective regulations within the given timeframe. They must establish new procedures for the management and storage of serial numbers, which in turn requires the adaptation of highly sophisticated packaging processes in-line with global strategies. This calls for a sophisticated software architecture, which is able to integrate the serial numbers consistently on all levels – from devices, line processes and line management to production and enterprise control. A multi-layer and modular machine and software concept is obviously the safest option. It must be compatible with existing line concepts, allowing for the development of a complete system that complies with the industry's demand for safe, high-quality and consistent operations.

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Part 1 of the article: "New Markets Need New Best Practices and Manufacturing Concepts" has been published in CHEManager International 5/2014.

Bosch's KKX 3900 simultaneously inspects process quality parameters such as weight, length and condition of filled capsules

Serialization – ensuring pharmaceutical safety right to the end of the supply chain

Bosch's modular Carton Printing System (CPS) with Tamper Evident module fulfills the requirements for a combination of serialization, traceability and authentication

Events

Pharma Outsourcing & Procurement Summit 2014, 11–12 June, 2014, Berlin, Germany

Pharmaceutical outsourcing is growing exponentially amidst challenging price restrictions, U.S. health care reforms and reduced revenues. The summit addresses the urgent need for the pharmaceutical industry to identify and locate the best pharmaceutical outsourcing partnerships and solutions to stay competitive in an uncertain climate whilst addressing heightened regulatory pressures and need to maintain high quality standards. The growing pharmaceutical outsourcing requirements in contract manufacturing, bulk, fill finish, drug delivery and API sourcing are in the focus as well.

▶ www.outsourcingevent.com

Advanced Drug Delivery Approaches for Small and Large Molecules, 12 June 2014, St. Paul, Minnesota, USA

The Innovation Showcase symposium and networking event of the Catalent Applied Drug Delivery Institute is focused on drug delivery challenges facing R&D teams today. Experts from 3M, Catalent Pharm Solutions, Agere and Xhale will provide insights and solutions for current drug delivery challenges. Topics include: innovative strategies for overcoming challenges in the delivery of poorly soluble drugs, benefits of utilizing new drug delivery technology platforms, and thoughts from industry & academic experts on how to help deliver better treatments for patients. This event is complementary, but registration is limited to the first 125 registrants.

▶ www.drugdeliveryinstitute.com/events

Chemspec Europe 2014, 18–19 June 2014, Budapest, Hungary

The annual European fine and specialty chemicals exhibition will take place in Budapest for the first time, providing a gateway to the Eastern European markets for custom, fine and specialty chemicals. Showcasing a series of conferences, seminars and workshops the event offers a broad spectrum of information on products, technologies and regulatory issues. They include the RSC Speciality Chemicals Symposium, a Pharma Outsourcing panel discussion, an Agrochemical Intermediates conference, the Regulatory Services Zone, and Pharma as well as Green Chemistry Workshops. On the day before the exhibition opens, the European Fine Chemicals Group (EFCG) holds their 5th annual Crop Protection & Fine Chemicals Forum the afternoon of 17 June.

▶ www.chemspeceurope.com

BIO International Convention 2014, 23–26 June 2014, San Diego, California, USA

The annual convention of the Biotechnology Industry Organization (BIO) covers the wide spectrum of life science innovations and application areas. Drug discovery, bio-manufacturing, genomics, biofuels, nanotechnology, and cell therapy are just a few of the industries represented. The key elements of the event are education, networking, BIO business forum partnering and the 1,700 companies showcasing the latest technologies, products and services in the BIO Exhibition. More than 15,000 attendees are expected. On Tuesday, 24 June, special guest and keynote speaker is Sir Richard Branson, on Wednesday, 25 June, special guest and keynote speaker is former Secretary of State Hilary Rodham Clinton.

▶ www.convention.bio.org

Specialty & Agro Chemicals America, 8–10 September 2014, Charleston, South Carolina, USA

Specialty & Agro Chemicals America focuses on the chemical products and technologies that have specific applications for the agrochemical and specialty chemical manufacturing markets. The event's mission and vision is to be a forum that narrows the focus and renews the value for chemical industry participants. Participants cover a diverse range of chemical end-uses including adhesives & sealants, agriculture & crop protection, coatings & paints, cosmetics & personal care, flavors & fragrances, oilfield & lubricants, pharmaceuticals, plastics & composites, and water treatment. The conference program includes a mix of presentations focused on both the agrochemical market and broader specialty chemical industry - with presentations covering the current EPA regulatory landscape and the chemical M&A/private equity environment.

▶ www.chemicalsamerica.com

China Petroleum & Chemical Industry Conference (CPCIC), 10–12 September 2014, Tianjin, China

The topics chosen for this year's CPCIC reflect the changes happening in China's chemical industry as it consolidates at home, looks for acquisitions abroad, and helps to solve the needs of a rapidly-growing and urbanizing population with a fast-emerging middle class. Sessions will focus on: chemistry and transportation - innovative materials for automobiles; the chemical industry and city development - environmentally-sustainable building standards and materials; China and the global chemical industry: the next 10 years - insights on the development of the petroleum and chemical industry from the leaders of multinational companies. In addition, mergers and acquisitions, global trends and investment flows, the dynamics of chemical trade flows in Asia, and overseas opportunities for China's industry players will be covered.

▶ www.cvent.com

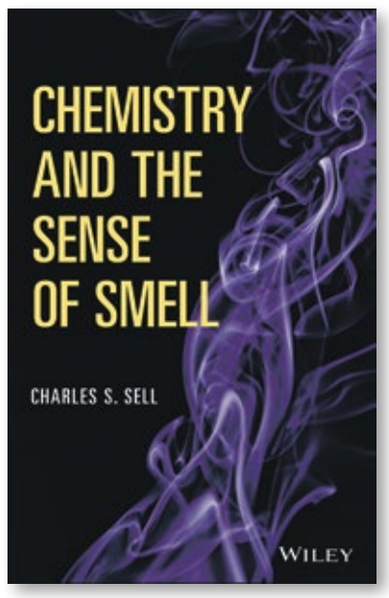
23rd Fakuma – International Trade Fair for Plastics Processing, 14–18 October 2014, Friedrichshafen, Germany

1,288 companies have registered to participate at the Fakuma, international trade fair for plastics processing. The exhibitors, including manufacturers, distributors and dealers, will come from 32 countries this year. Germany will be represented by 675 exhibitors, followed by Italy with 72 manufacturers and distributors and Switzerland with 66 companies. Austria, China and the Netherlands place 4th, 5th and 6th with 27, 24 and 22 companies respectively. As in the past, there's no lack of technological innovations in the field of plastics. This is made plainly apparent by trends such as energy and material-saving production and processing of plastics, expanding use of composite materials, improved precision injection moulding of components used in micro-technology and medical engineering, advancing functions integration despite miniaturisation and components/modules with ever thinner walls, new applications for rotation moulding technology like the thermoforming process, and last but not least 3D printing.

▶ www.fakuma-messe.de

Chemistry and the Sense of Smell

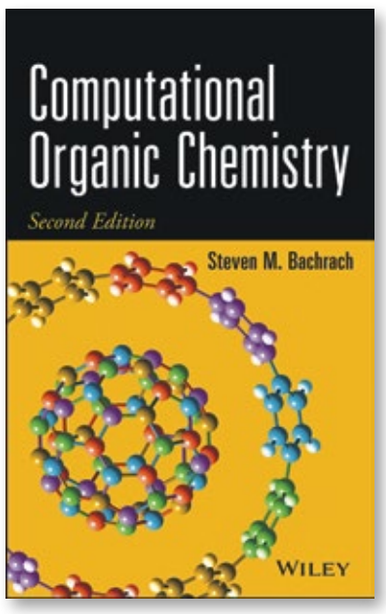
The book provides an account of the totality of fragrance chemistry in one volume. It describes the chemistry of odorous materials, how and why they are produced in nature, how they are produced and used commercially, how they are analyzed and characterized, the chemistry of how we perceive them and their role in our everyday lives. The final chapter reviews the major intellectual challenges for fragrance chemists and considers the future of the field.



▶ Chemistry and the Sense of Smell
Charles S. Sell
John Wiley & Sons
Price: € 129,00
ISBN 978-0-470-55130-1

Computational Organic Chemistry

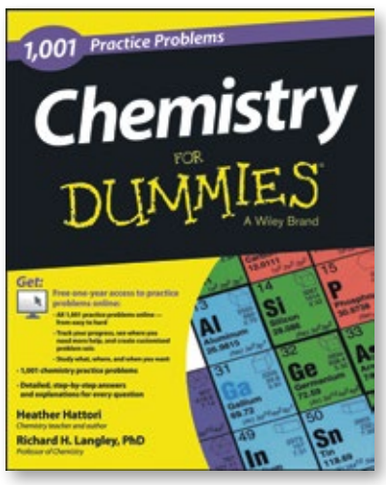
Building upon and updating the successful first edition, the second edition of Computational Organic Chemistry introduces computational modeling methods used as standard tools by organic chemists for searching, rationalizing, and predicting structure and reactivity of organic molecules. New coverage includes: significant problems with standard DFT (density functional theory) methods; ways to address these problems; computational organic spectroscopy; computational tools for understanding enzyme mechanisms; and new interviews. The text is particularly valuable to organic, physical organic, synthetic organic and computational chemists using computational tools.



▶ Computational Organic Chemistry
Steven M. Bachrach
John Wiley & Sons
Price: € 109,00
ISBN 978-1-118-29192-4

Chemistry: 1,001 Practice Problems For Dummies

Practice makes perfect — and helps deepen your understanding of chemistry



1,001 Chemistry Practice Problems For Dummies takes you beyond the instruction and guidance offered in Chemistry For Dummies, giving you 1,001 opportunities to practice solving problems from the major topics in chemistry. Plus, an online component provides you with a collection of chemistry problems presented in multiple-choice format to further help you test your skills as you go. It

- gives you a chance to practice and reinforce the skills you learn in chemistry class
- helps you refine your understanding of chemistry.
- practices problems with answer explanations that detail every step of every problem

Whether you're studying chemistry at the high school, college, or graduate level, the practice problems in 1,001 Chemistry Practice Problems For Dummies range in areas of difficulty and style, providing you with practice help.

▶ Chemistry: 1,001 Practice Problems For Dummies
Heather Hattori, Richard H. Langley
John Wiley & Sons
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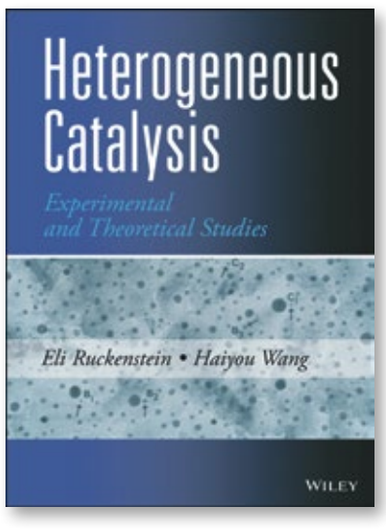
Heterogeneous Catalysis

Consolidating a collection of papers that Professor Eli Ruckenstein and his co-workers have published over the past four decades, Heterogeneous Catalysis Contributions to Experimental and Theoretical Studies addresses catalysts involved in reactions such as methane CO_2 reforming, methane partial oxidation, and catalytic combustion. Each chapter opens with an introduction summarizing the papers included in the chapter and highlights the relevance of the chemistry to todays R&D. This valuable resource for catalytic and material scientists and graduate students paves the way to help develop new chemicals and materials



▶ Heterogeneous Catalysis
Eli Ruckenstein, Haiyou Wang
John Wiley & Sons
Price: € 169,00
ISBN 978-1-118-54690-1

People

Marcus Kuhnert

Marcus Kuhnert has been appointed new chief financial officer and member of the Executive Board with unlimited personal liability of German chemicals and pharmaceuticals producer Merck KGaA, effective Aug. 1, 2014. Since 2010, the 45-year-old manager born in Chicago, Illinois, USA has been CFO of the Laundry & Home Care business unit at Henkel, with sales of €4.6 billion annually. He succeeds **Matthias Zachert**, who left Merck to head Lanxess at the beginning of April.

Randy Woelfel resigned as CEO of Canada's Nova Chemicals on May 1. His departure was announced shortly before the company's first-quarter earnings conference call. In a statement the Canadian chemical producer said its board of directors and chief executive had been unable to agree on mutually satisfactory contract renewal terms and that the resignation was not due to differences of opinion about Nova's overall business strategy. **Todd Karran**, the company's chief financial officer, has been appointed acting CEO to serve until a permanent chief executive has been found. Woelfel had headed Nova since 2009.

Peter Skou, managing director of the distribution company R2 Group and treasurer of the European Association of Chemical Distributors (FECC), was elected President of the International Council of Chemical Trade Associations (ICCTA). Established in 1991, ICCTA represents the interests of around 1,600 chemical distributors world-wide. ICCTA coordinates programmes of international interest across national and regional chemical trade associations. ICCTA provides a platform where chemical distributors can meet to exchange information and best practises. As member of the FECC Board, Skou has served as FECC treasurer for the past four years, playing a pivotal role in the recent developments of the association.

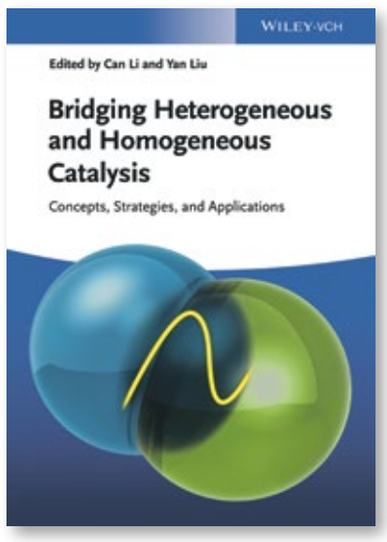
Rolf Stahel has been appointed to non-executive chairman of Ergomed, a UK-based drug development services company. Rolf Stahel brings over 30 years' experience in the global pharmaceutical industry. He led Shire Pharmaceuticals Group plc as CEO from March 1994 to 2003 and during his tenure implemented six mergers and acquisitions transforming the private $30 million company into a FTSE 100 company.

Daniel C. Smith has been appointed to Chief Scientific Officer of Cobra Biologics with the responsibility for enhancing Cobra's DNA, virus, microbial and mammalian proteins R&D platforms. Smith has spent the last 4 years with the BioProcessUK team at the HealthTech & Medicines Knowledge Transfer Network (KTN), driving the innovation agenda for biologics bioprocessing in the UK as a Knowledge Transfer Manager. He also delivered a number of projects enhancing industrial and academic collaboration as well as innovation in bioprocessing. Prior to work at the KTN, he gained industrial experience at Cobra in a variety of roles progressing from senior scientist to Commercial Scientific Development Manager.

Marcella McSorley joins SGS Life Science Services, a pharmaceutical analytical and bioanalytical contract solutions provider as quality assurance manager at its new North American GMP/GLP laboratory in Carson, California. The Carson facility is due to open in the third quarter. McSorley comes from Aaron Industries, where she served as director of quality control for analytical chemistry, microbiology and stability disciplines and oversaw the FDA-approved OTC Pharmaceutical manufacturing facility Alpha Therapeutic Corporation (now Grifols). **Pojaman Zunggeemoge** has been appointed to microbiology manager at SGS in Carson. In this position she will ensure ongoing compliance with SOPs. Zunggeemoge moves from Grifols Biologicals, where she was QC microbiology supervisor, responsible for adherence to cGMP protocols, company specifications and procedures.

Bridging Heterogeneous and Homogeneous Catalysis: Concepts, Strategies, and Applications

There are two main disciplines in catalysis research — homogeneous and heterogeneous catalysis. This is due to the fact that the catalyst is either in the same phase (homogeneous catalysis) as the reaction being catalyzed or in a different phase (heterogeneous catalysis). Over the past decade, various approaches have been implemented to combine the advantages of homogeneous catalysis (efficiency, selectivity) with those of heterogeneous catalysis (stability, recovery) by the heterogenization of homogeneous catalysts or by carrying out homogeneous reactions under heterogeneous conditions. This unique handbook fills the gap in the market for an up-to-date work that links both homogeneous catalysis applied to organic reactions and catalytic reactions on surfaces of heterogeneous catalysts. As such, it highlights structural analogies and shows mechanistic parallels between the two, while additionally presenting kinetic analysis methods and models that either work for both homogeneous and heterogeneous catalysis. Chapters cover asymmetric, emulsion, phase-transfer, supported homogeneous, and organocatalysis,

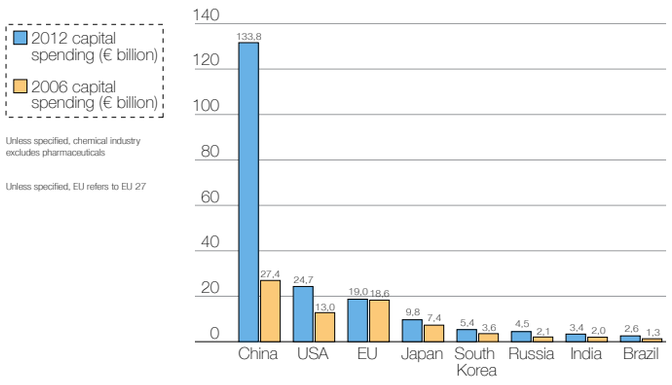


as well as in nanoreactors and for specific applications, catalytic reactions in ionic liquids, fluorous and supercritical solvents and in water. Finally, the text includes computational methods for investigating structure-reactivity relations.

▶ Bridging Heterogeneous and Homogeneous Catalysis
Can Li, Yan Liu
Wiley-VCH
Price: € 159,00
ISBN 978-3-527-33583-1

Capital and R&D Spending of the EU Chemical Industry

China dominates world chemicals investment



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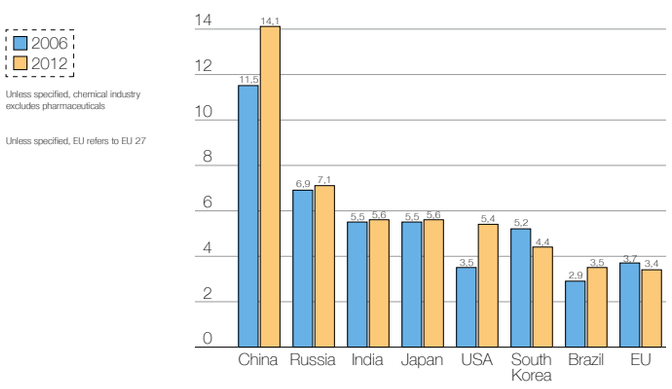
Low EU capital spending intensity

Chemicals capital spending Intensity (% sales)



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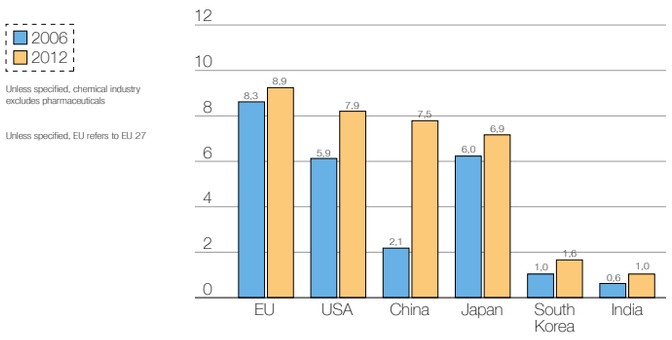
EU outspends industrial and emerging countries in chemicals R&D

Chemicals R&D spending (€ billion)



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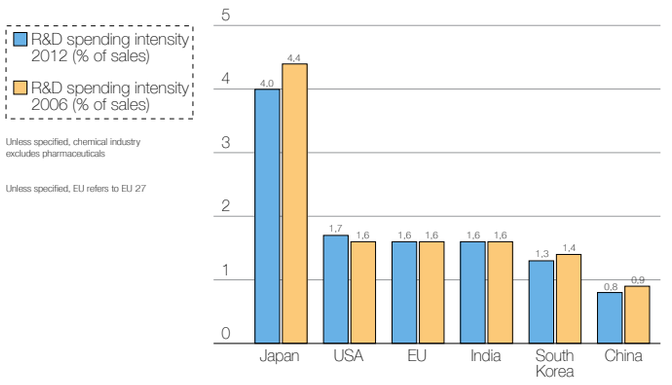
Chemicals R&D intensity highest in Japan



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Capital Spending

In absolute figures, chemical industry investment in the EU had been increasing from 2004 to 2008, registering a positive trend at a consistent pace. Investment during 2009, however, experienced a steep decline compared to 2008, down by 22.5%. Investment remained relatively stable in 2010. The chemicals sector registered a significant increase in 2011, moving up from €16.7 billion in 2010 to €18.5 billion in 2011 and further up in 2012 to reach €19 billion. Chemical industry capital spending in the EU reached the level of €19 billion in 2012. It represents 9.4% of the €203.3 billion spent by the eight largest chemicals-investing countries.

Capital Intensity

In relative terms, the ratio of capital spending to sales, or capital intensity, of the EU chemical industry has been declining since 1999 and reached the value of 3.4% in 2012, down from 5.7% in 1996. Capital spending intensity in China and other emerging economies is far higher than in the rest of the world. Capital intensity for China increased considerably from 11.5% in 2006 to 14.1% in 2012. All major chemicals producing countries increased their chemicals spending intensity from 2006 to 2012 apart from two regions: South Korea and the EU. The EU continues to lag behind leading chemicals-producing regions and has been registering a constant decline during the past ten years.

R&D Spending

In absolute figures, spending on research and development in the chemical industry was valued at an average annual level of €8.3 billion in the EU during the period from 1996 to 2012. In relative terms, the ratio of R&D spending to sales, or R&D intensity, of the European chemical industry has been declining, down from 2.2% registered in 1996 to 1.6% in 2012.
In absolute figures, R&D spending in the EU chemical industry was valued at an average annual level of €8.3 billion during the period from 2006 to 2012. In the U.S., the average value of R&D spending per year was €6.6 billion during the same 7-year period and €6 billion for the Japanese chemical industry.

R&D Intensity

Wide variations in research and development (R&D) efforts are observed across the world chemical industry. Turning R&D into innovation is becoming increasingly important for a region's competitiveness.
Analysing the ratio of R&D spending to sales of the chemical industry, the R&D intensity level in the EU was far below that of Japan and slightly lower than in the U.S. during the 7-year time period from 2006 to 2012. Japan chemicals R&D intensity was more than double U.S. and EU levels in 2012.
The EU R&D intensity was 1.6% on average during the years 2006 to 2012, while the same ratio equalled 4.1% in Japan. China R&D intensity remains still far below U.S. and EU levels.

Brazil's Striving for Sustainability

As the 2014 FIFA World Cup is just around the corner, the host country, Brazil, is eager to prove to the world that it is able to stage the most sustainable tournament in the history of soccer's crowning event. As always when it comes to mass rallies like major sports events, critics accuse the organizers of environmental destruction and waste of energy. Therefore the world football association FIFA and the local Brazilian organizing committee made an effort from the very beginning to arrange a sustainable World Cup by taking appropriate measures.

Plastics play an important role in achieving the sustainability goals. The implementation of this general statement will be found in many places during the World Cup, e.g., in the construction of the soccer stadiums (c.f. photo caption below), the players' equipment, the packaging of food and beverages, and in transportation and infrastructure. We find a broad range of innovations that improve efficiency, enhance performance and increase sustainability — developed by the chemical industry worldwide.

Another example for sustainability in Brazil is also coming from the chemical industry: AkzoNobel's new €80 million Imperatriz Chemical Island has just started supplying the Suzano Maranhão Pulp Mill in northern Brazil.

The state-of-the-art Imperatriz facility represents AkzoNobel's second major investment in the Brazilian pulp industry within a two-year time frame. It will supply, store and handle all chemicals for the 1.5 million t/y Suzano mill under an agreement which runs for the next 15 years. The Imperatriz plant will play an important role in ensuring a sustainable eucalyptus pulp supply to the global marketplace.

AkzoNobel already operates the Chemical Island concept at three pulp mills, served by the Eunápolis, Jupiá and Três Lagoas sites respectively.

Find out more about Brazil in our Regions feature on pages 11 to 16 in this issue. ■

Brasilia's New Landmark – At the FIFA World Cup 2014, besides the international soccer players, the stadiums will be the secret stars of the tournament. And the new Estadio Nacional in Brasilia has what it takes to become the new landmark of Brazil's capital. The soaring columns that surround the stadium bowl and shore up the circular roof disk provide the arena with the esthetic appeal of a soccer temple. In the planning of a sports stadium roof, many different requirements must be taken into consideration, such as safety, weather resistance, transparency, economic feasibility, and, last but not least, an attractive design that fits into the overall setting of the stadium and its surroundings. The roofing of the arena in Brasilia sports sturdy, highly impact-resistant, and break-proof Makrolon polycarbonate sheets from Bayer MaterialScience. The polycarbonate sheets have a light transmission of 82%, ensuring optimum natural light for healthy turf growth.

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