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HPINNOVATIONS

Selected by ***Hydrocarbon Processing*** **editors**

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Highly accurate flowmeter replaces turbines, PD meters

KROHNE, Inc., has developed the ALTOSONIC III. It is claimed to be the first three-beam custody transfer ultrasonic flowmeter, which is intended to replace turbines and PD meters in the fiscal measurement of light liquid hydrocarbons.

The highly reliable technology meets the need for an ultrasonic flowmeter for single products with all the advantages of ultrasonic flowmeters plus the custody-transfer metering requirement of the oil industry. For custody transfer, the meter offers 0.2% accuracy and is compliant with OIML R-117.

Having no moving parts, the product eliminates problems with clogging, scaling or blockage. Because of no wear and tear, there are no maintenance or recalibration costs. The performance accuracy of the ALTOSONIC III virtually ensures that periodic recalibration is unnecessary, according to the company.

With no pressure loss, the need to upsize pumps—with the corresponding costs for procurement and electricity costs—is avoided. The flowmeter is bidirectional, while the three beams offer built-in redundancy in the unlikely event of a sensor failure (Fig. 1). Retrofitting is easy, as the product slots directly into the position taken by a turbine with a simple flow straightener.

Fig. 1 Unique three-beam custody transfer ultrasonic flowmeter.

The flowmeter's predecessor, the ALTOSONIC V, is a pioneering custody transfer ultrasonic flowmeter using a multibeam design suitable for multiproduct measurement. The success of ALTOSONIC V was a major reason for the acceptance of ultrasonic measuring technologies by the American Petroleum Institute (API), according to KROHNE.

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Pilot project investigates new methanol synthesis route

Mitsui Chemicals Inc. (MCI) is constructing a pilot facility to further develop a methanol synthetic process from carbon dioxide (CO_2). Under environmental programs, the company's basic strategy is to create an innovative process that significantly reduces greenhouse gases.

Part of this effort encompasses the "chemical immobilization of CO_2" methodology that synthesizes methanol to be used later to produce olefins and aromatics (Fig. 2). The CO_2 is sourced to emissions from factories and hydrogen obtained from water photolysis.

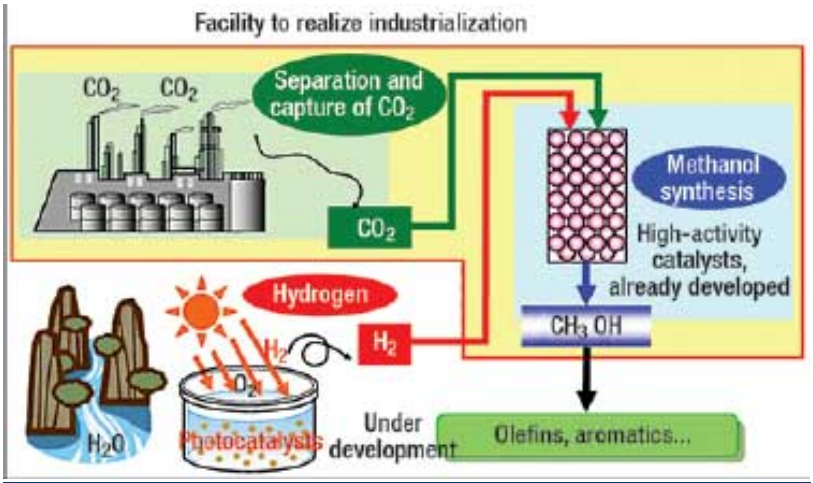

Fig. 2 Chemical immobilization of CO_2 that yields methanol.

A new pilot plant is a further step to industrialize methanol synthesis and the separation and capture processes for CO_2. Since 1990, MCI has participated in the Chemical CO_2 Immobilization Project—an initiative launched by the Research Institute of Innovative Technology for the Earth. Utilizing this joint research, the company claims that it has succeeded in developing ultra-high-activity catalysts that will be upgraded and used at the new pilot facility.

The pilot plant will have a capacity of 100-tpy of methanol with an approximate investment of ¥1.5 billion. Located at MCI's Osaka facility, construction is scheduled for completion by March 2009, with the

unit operational by March 2010.

Select 2 at www.HydrocarbonProcessing.com/RS

MPC squeezes out more profits and efficiency

ADMC 64 is CTC's newest and most advanced model predictive controller (MPC). Olefin plants have always been a problem for dynamic matrix control (DMC) and other traditional MPCs. Before ADMC 64 and open-loop modeling, either a composite LP had to be used or the number of coefficients had to be reduced to under 300 with calculation intervals of every 2 minutes or longer.

The new MPC easily handles 600 coefficients with calculation times under 10 seconds on an Intel quad PC running Microsoft Server 2008. CTC tested it on a problem with 240 manipulated variables and 554 controlled variables and 600 coefficients. The calculation time on the Intel Quad runs in 5.5 seconds.

Also, ADMC is backwards compatible and will run as a high-performance, traditional DMC controller by downgrading to a closed-loop model. The technology is field proven from the inventors of the DMC algorithm in 1985. DMC is still used in over half of the world's process control applications.

Select 3 at www.HydrocarbonProcessing.com/RS

Catalyst for low and medium-pressure ultra-low-sulfur diesel

Albemarle Corp. has developed a new catalyst that can improve hydrodesulfurization (HDS) unit performance by 35% over other active catalysts within the marketplace. The new product, Ketjenfine 770 hydrodesulfurization catalyst, is based on Albemarle's patented STARS technology.

The catalyst is claimed to enable ultra-low-sulfur diesel (ULSD) refiners to improve their operating margins substantially by increasing catalyst cycle length, boosting throughput or running lower cost, low-quality feedstocks without additional capital expenditure.

The catalyst can deliver real value to the marketplace at a time when refiners are being stretched by increasing diesel demand and more stringent fuels specifications. The product is designed for operation in low- to medium-pressure ULSD units. In these processing units, the chemistry to remove refractory sulfur is complex and challenging. The removal rate of sulfur species at these conditions is determined by the number of direct desulfurization sites (DDS) on the catalyst surface.

Ketjenfine 770 catalyst is engineered to contain the maximum number of DDS. The catalyst is thus particularly effective at conditions of low hydrogen availability, either through low partial pressures of hydrogen and/or through low gas rates.

The new product is a cobalt-molybdenum catalyst on activated alumina. The carrier and active metals were modified to maximize the stability of the catalyst during its operation. Stability of ULSD catalyst is not solely a function of the unit's operating conditions, but is also partly controlled by catalyst design properties.

Refiners can also take advantage of the catalyst's premium performance by increasing throughput or processing heavier feedstocks. Intake of just 7% extra light cycle oil (LCO), for example, can generate an additional annual profit of more than $15 million for a 40,000-bpd unit, assuming a margin of $15/bbl for upgrading LCO to ULSD.

As with other STARS catalysts, the new product can be used in multiple consecutive cycles. Through REACT technology, a process of regeneration and rejuvenation, the spent catalyst can be recovered to a performance level that is close to its fresh activity. Refiners can profit at least twice from the premium activity of Ketjenfine 770 catalyst, subject to their specific operating conditions.

The new catalyst will be available from production sites in the Netherlands and US. The product is already being sold in Europe, and is commercially available to refiners worldwide.

Select 4 at www.HydrocarbonProcessing.com/RS

First cut-to-length mineral insulated heating cable for temperatures to 425ºC

UK-based Heat Trace Ltd. has launched a patented, parallel resistance, convenient cut-to-length AHT-type product suitable for all applications that could previously only be met by old-style mineral-insulated (MI) cables.

Metal sheathed and mineral insulated (MI), the new cable has a withstand temperature of 425°C and power outputs in the range of 15 to 150 watts/meter.

Traditionally, heat tracing applications having a high-power or high-temperature requirement (outside the limits of polymers) have had to be satisfied by means of series resistance, metal-sheathed MI heating cables. Such solutions need to be individually designed for each application and pipe length and are difficult to terminate and install. With limited available resistances, low voltage transformers are often needed when short cable lengths are required.

By comparison, parallel constant-power (zonal) tracers provide a popular, alternative choice as they can be conveniently cut to suit pipe lengths. Until recently, however, they were all of polymeric construction and so were limited in temperature and output capability.

With the introduction of this latest type AHT product, Heat Trace Ltd. offers a solution for virtually all applications that could previously only be met by the old series MI cables. Thus, cut-to-length parallel tracers are now available for virtually all heat tracing applications.

AHT is particularly beneficial in the case of instrument lines, the lengths of which are usually not known at a project's design stage. These are generally site run according to convenience. The AHT range carries approvals for use in hazardous areas, with accreditations including IEC (world), ATEX (Europe), IEEE and CSA (N. America) and GOST (Russia). The AHT cable also has patents in Europe, the US and Canada.

Select 5 at www.HydrocarbonProcessing.com/RS

Novel, high-efficiency heat exchanger and reactor

Ehrfeld Mikrotechnik BTS GmbH (EMB), a wholly-owned subsidiary of Bayer Technology Services GmbH, has an exclusive worldwide license agreement with Mingatec GmbH for marketing and manufacturing novel miniaturized heat exchangers and reactors.

The heat exchangers, based on patented Miprowa technology, are claimed to have a substantially greater heat-transfer capacity and to be significantly less sensitive to fouling. They also are easier to clean than conventional apparatus.

This field-proven technology supplements the EMB portfolio of microstructured apparatus and modules for laboratory and technical service-center facilities in the high-throughput range of several tons of product/hour for production operations.

The Miprowa technology is based on flat, rectangular channels with easily removable, structured layers extending edge-to-edge on the inside. Several such layers are overlaid to form a fine, flat, flow-through

matrix (Fig. 3). This is claimed to homogenize the flow of fluid across the entire channel cross-section and along the channel's full length. It also quickly degrades temperature gradients.

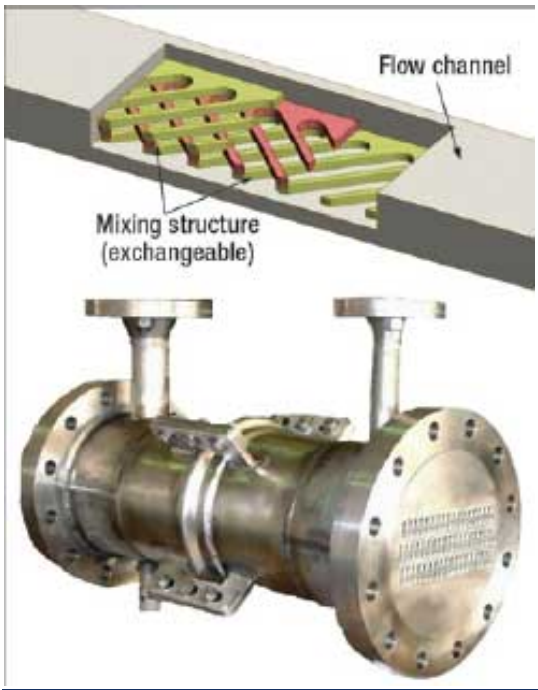

Fig. 3 Heat exchanger technology is based on flat, rectangular channels.

The intensive redirection of the product in the flat matrix and at the attemperation surfaces increases heat transfer performance while simultaneously reducing contact times, which benefits temperature-sensitive products.

A cross-sectional geometry optimized for the process can allow foreign particles to pass without filtering them and prevents blockages.

The compact design and resultant short attemperation and residence times help to avoid thermal damage to the product and suppress undesired secondary reactions. The low volume of the product-side apparatus also reduces the plant's hazard potential. Flexible design of the layer geometries enables optimizing important process parameters such as pressure loss and attemperation performance.

The heat exchanger can easily be inspected and cleaned by simply withdrawing the layer package from the Miprowa channels. It is available standard in CrNi (stainless steel) or nickel alloys. The technology offers users a new engineering tool for process optimization, particularly for heat transfer and the continuous performance of exothermic reactions.

Select 6 at www.HydrocarbonProcessing.com/RS

Heat quench column achieves lower carbon emissions for LNG

Black & Veatch has received a US patent for a heat quench column that adds to the company's sustainable solution set. It is claimed to achieve lower carbon emissions for vaporizing liquefied natural gas (LNG) while maintaining low operating costs.

LNG occupies 1/600 of the volume of its vaporized gas equivalent, making the liquid fuel ideal for shipping and storing. However, revaporizing natural gas requires significant heat energy. Submerged

combustion vaporization (SCV) is commonly used for revaporization because of its high thermal efficiency. SCV technology for large-scale LNG import produces higher emission amounts.

The patented technology works by capturing and reusing excess heat energy from a fired heater or combustion turbine discharge during the regasification process to achieve efficiencies approaching 97%, depending on unit size and configuration.

"Development of LNG infrastructure is important to bringing a stable and long-term natural gas supply to the US and other parts of the world," said Dean Oskvig, president and CEO of Black & Veatch's global energy business. "However, environmental concerns have slowed development in some regions due to emissions generated from the revaporization process. Black & Veatch's innovative technology answers this complex challenge."

Select 7 at www.HydrocarbonProcessing.com/RS

Analysis of polymers soluble only at elevated temperatures

Viscotek offers Model 350 High Temperature GPC (HT-GPC). This is claimed to be a revolutionary advanced detector system specifically designed for the characterization of polyolefins and other synthetic polymers that are soluble only at elevated temperatures.

The system provides absolute molecular weight without extrapolation or correction, molecular size (Rg and Rh to less than 1 nm) and intrinsic viscosity, as well as information on branching, structure and aggregation in a single GPC/sec experiment. The system may also be configured with an infrared detector for short-chain branching analysis or a UV/VIS detector for copolymer compositional analysis.

Designed in a modular component format, the HT-GPC features automated sample preparation and delivery, self-cleaning in-line sample filtration and a detector module that is easily removed from high-temperature environments for routine maintenance.

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Sulfur spectrometer handles rigorous fuel regulations

With regulations on acceptable levels of sulfur in diesel fuels tightening worldwide, the need is heightening for analysis systems that offer maximum sensitivity and extremely low limits of detection.

PANalytical's compact energy-dispersive X-ray fluorescence spectrometer—MiniPal 4 Sulfur—is claimed to be designed for accurate and precise petrochemical analysis. The instrument performs nondestructive measurement of elements from sodium to lead, in concentrations from 100% to ppm-levels (Fig. 4).

Fig. 4 Compact energy-dispersive X-ray fluorescence spectrometer.

The analyzer delivers improved sensitivity, excellent resolution and lower limits of detection. The system claims to have best-in-class performance with results from a 15-kV silver anode tube that avoids overlap with sulfur signals and a new silicon drift detector. The spectrometer is easy to use due to its powerful system software and an automatic program selection. The program selects the most appropriate calibration relative to the sulfur content of an unknown sample.

Elemental analysis of petroleum products is crucial for quality control and to comply with environmental regulations. The new spectrometer meets the requirements for sulfur analysis according to all relevant international norms and standards, including ASTM, ISO, DIN and EPA.

In January 2009, European Union (EU) countries face the new Euro V regulations, with its 10-ppm limit on sulfur in ultra-low-sulfur diesel (ULSD). Through a series of incentives and local initiatives, many EU countries are already in line with the standard. In the US, the EPA has mandated the reduction of sulfur content in ULSD to 15 ppm. All highway diesels must meet this standard by December 2010.

In Asia, many national environmental bodies, those in Taiwan and Singapore for example, have adopted the current Euro IV standard and are likely to move to the tougher Euro V.

Key features and benefits of the new technology include:

- One of the smallest full-function spectrometers
- Best resolution in class
- Robust, reliable and cost-effective
- 12-position sample changer
- Three tube filters
- Helium gas attachment for light element analysis
- 15-kV silver anode X-ray tube for optimum performance with phosphorous, sulfur and chlorine analysis in petrochemicals.

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Reliable biodiesel analysis using an emission spectrometer

Thermo Fisher Scientific Inc. has incorporated unique capabilities in the iCAP 6000 Series of ICP emission spectrometers to achieve dependable monitoring of elemental contaminants in biodiesel. The dedicated radial plasma view configuration of the system is claimed to provide enhanced analytical capabilities for important elements such as sulfur and phosphorus. The enhanced matrix tolerance torch and swing frequency RF generator easily handle organic matrix samples and ensure improved stability.

The majority of biodiesel production facilities use plant oils as a starting material for production. However, these plants usually have relatively high phosphorous content that is undesirable in fuels as it can lead to corrosion of mechanical engine components. Sulfur also affects engine wear if present in excess concentrations in the starting materials and causes environmentally harmful sulfur dioxide emissions.

EN 14214 and ASTM D6751 standards have been introduced specifying the requirements for biodiesel and its analysis. These documents require that the concentrations of elemental contaminants in biodiesel are regularly monitored and specify the method for its analysis.

Traditionally, axial view ICPs have been the configuration of choice for ICP emission spectrometers used to perform biodiesel analyses because of their perceived lower detection limits. With robust dedicated radial view plasma and the elimination of carbon-based emission interferences associated with the axial view configuration, the iCAP 6000 Series radial view is a powerful alternative.

This configuration demonstrates improved detection limits for lower concentrations of samples, being capable of providing accurate, dependable analysis of phosphorus, sulfur and potassium. This is a crucial benefit since regulation detection limits must be 10 times below the regulated concentration levels to provide sufficient margin to ensure a sensitive measurement.

Additionally, the new emission spectrometers have full wavelength coverage from 166 nm to 847 nm with full-frame capability, offering full-spectrum trend analysis and contamination identification between batches of biodiesel produced. Their advanced optical design enables improved resolution and detection limits.

The systems are fitted with a fourth-generation CID detector that offers a wide dynamic range, resistance to saturation and greater detection capability. The spectrometer incorporates fully automated wavelength calibration and offset correction capabilities for excellent long-term stability.

The instrument's distributed purge system offers reduced gas consumption and improved performance for elements that emit light in the UV region of the spectrum. The ergonomic design with a large, wide-opening door enables easy access to the sample compartment and peristaltic pump, making routine maintenance easy and fast.

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Acid gas enrichment at zero operating cost

TKK Company has developed the patented process HIGHSULF (patents: 5,556,606, 5,718,872, 6,506,349 and 2,204,351), which provides H_2S-rich feeds for sulfur recovery units (SRUs) in a single step, eliminating the need for separate enrichment. The efficiency of the H_2S oxidation reaction and sulfur recovery increases at higher H_2S concentrations in the feed to SRUs. The higher H_2S concentration, combined with lower hydrocarbon and CO_2 concentration in the sulfur plant feed, generates tail gas with reduced mass flow.

There are known correlations between H_2S concentration, hydrocarbon and CO_2 content in the feed and the initial sulfur plant investment cost and tail gas treating unit (TGTU). In fact, combustible contaminants impact both installation and operating costs. Diluents such as N_2 or CO_2 may increase the plant cost since most sulfur recovery equipment is sized on the basis of mass flow. The major equipment and process piping increases in size, causing overall investment to increase. In gas processing plants, there can be high concentrations of hydrocarbons in the feed gas. These hydrocarbons generate COS and CS_2 in the thermal stage of the Claus unit and an undesirable mass of

CO_2.

In a typical amine gas sweetening process, rich amine is sent to the regenerator column to generate lean amine. All acid gas obtained at the top of the regeneration column is used as Claus SRU feed. The absorber feed gas stream is enriched by using part of the H_2S produced in the acid gas. This enriched gas enters the absorber with higher partial pressure of H_2S than in the original raw gas inlet stream. A physical solvent, at relatively high pressure, may be used for processing natural gas to remove CO_2, H_2S, COS and CS_2. A chemical solvent would be used for the process of removing (absorbing) H_2S and CO_2 from feed streams in gas processing plants or refineries operating at relatively low pressures.

For typical natural gas processing plants with low H_2S concentrations, the new process yields acid gas with higher H_2S concentrations than by using conventional amine treatments. Table 1 compares acid gas compositions using conventional amine treatment and the new process for acid gas removal for natural gas and gas-fired plants. The computer simulation results illustrate that the H_2S concentration in acid gas is 39% greater than in conventional amine treatments while the hydrocarbon content in acid gas was reduced by 72%. For the gas-fired case, the acid gas contains more than twice as much H_2S and far less of other components, as indicated in Table 1.

TABLE 1. Acid gas composition of regular and new-process amine units

Gas plant acid gas components	Acid gas composition,mole% Regular amine unit, MDEA	HIGHSULF amine unit, MDEA
H_2S	33.10	46.20
CO_2	57.30	47.10
H_2O	8.53	6.40
Hydrocarbons	1.07	0.30
Gas-fired plant acid gas components	**Acid gas composition, mole% Regular amine unit, MDEA**	**HIGHSULF amine unit, MDEA**
H_2S	11.68	24.78
CO_2	79.11	68.42
CO	1.76	0.23
H_2O	6.40	6.38
COS	0.05	-
H_2	0.996	0.19
CH_4	0.004	-

The family of HIGHSULF processes (gas sweetening and TGTU) is claimed to bring an additional and new important dimension, such as controlled partial pressure of H2S in the feed of absorber, to gas sweetening and the control system. The concept increases CO_2 rejection in the absorber of amine units and retains the required H_2S level in the absorber overhead.

It also increases H_2S concentration in the acid gas, reduces hydrocarbons and controls the composition and the mass flow of acid gas of the TGTU going to the SRU. It reduces capital and operating costs for new and existing conventional TGTUs related to cooling requirements.

Other advantages of the process for amine units in natural gas desulfurization, acid gas enrichment and TGTU include:

- Reduces size of new SRU and increases existing units' capacity
- Substantially reduces hydrocarbons in SRU feed and provides longer catalyst life in the first reactor of SRU
- Produces sweetened gas that meets gas transmission line specifications
- Reduces amine loses
- Provides flexibility in the parallel SRU utilization to maintain production and product quality
- Eliminates SRU with split-flow configuration with its safety concerns for weak/lean acid gas processing
- Reduces duty of quench water trim cooler and lean amine water trim cooler in existing and new TGTUs
- Eradicates trim cooler problems that are typical of TGTUs in hot climates
- Has high turndown capability
- Any existing TGTU can be easily switched to HIGHSULF
- Any HIGHSULF TGTU can be switched back to regular TGTU and no unit shutdown is required.

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'Revolutionary' safety system

HIMA has released its latest safety product, HIMax. The innovation is claimed to be the first safety system designed to provide uninterrupted system operation throughout the entire life of a processing facility, by maximizing plant availability, productivity and safety.

It is based on HIMA's revolutionary Nonstop XMR technology that combines diagnostic-based SIL 3 safety integrity with a scalable fault-tolerant architecture. The design eliminates false trips and provides for unlimited changes, modifications, expansions, upgrades and regulatory proof testing without taking the plant off-line.

"With HIMax, plants are free to operate without being limited by their safety system," according to Rolf Hafner, head of product management at HIMA Germany. "No matter the safety system a plant currently uses, HIMax will actually improve plant productivity and profits because it prevents false trips and eliminates process system shutdowns which are usually needed to migrate from one version of the safety system to another."

Configuration and hardware and software changes can be made online, which means that planned shutdowns of the process plant are unnecessary. The nonstop performance of the technology can allow for return on total system investment within the first three months of use.

The product enables higher plant efficiency while reducing capital/project expenditures. With its flexible system architecture, centralized, distributed and remote I/O, it is easily integrated into a peer-to-peer communications network with no "engineering overhead" required. The technology allows for tight integration with any DCS using open-standard protocols guaranteed by the company, giving users the power to choose the best DCS for their plant.

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Industry joins with academia for six biofuels research centers

Royal Dutch Shell plc has embarked on six new research agreements with experts in academic institutions across the world. The ventures are part of a growing program designed to complement the company's own biofuels R&D and to accelerate results.

The program aims to investigate new raw materials and biofuels production processes, with a focus on improving efficiencies and lowering costs. The research agreements will last between two and five years. Participating institutions are:

- Massachusetts Institute of Technology, Massachusetts
- University of Campinas, São Paulo, Brazil
- Institute of Microbiology, Chinese Academy of Sciences, Beijing, China
- Qingdao Institute of Bioenergy and Bioprocess Technology, Chinese Academy of Sciences, Qingdao, China
- Centre of Excellence for Biocatalysis, Biotransformations and Biocatalytic Manufacture, based at Manchester University, UK
- School of BioSciences Exeter University, UK.

This announcement builds on Shell's 30-yr continuous investment in biomass R&D. The dedicated biofuels research and technology team presently works out of centers in Chester, UK; Houston, Texas; Amsterdam, The Netherlands; and Bangalore, India.

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