MEG process makes commercial debut under technology licensing deal

Licence to grow

The successful start up in Korea of the world's first plant to use Shell's OMEGA process for producing mono-ethylene glycol (MEG) is expected to accelerate interest in the new technology. The highly efficient process is attracting major players in the rapidly growing glycols market, with five technology licences already awarded to date.

When Royal Dutch Shell plc Chief Executive Officer, Jeroen van der Veer, said that delivering leading technology is a key role of international energy companies, he could well have had OMEGA in mind.

The OMEGA process employs a catalytic reaction to convert ethylene oxide into MEG as opposed to the traditional thermal conversion approach. The result is the most selective, highly efficient MEG process available, which has captured the interest of producers looking to respond to strong demand for MEG in Asia.

MEG is a vital ingredient for polyester fibres, film and PET packaging – all of which are seeing burgeoning demand.

In May this year, well ahead of schedule, a successful start up was completed in Daesan, Korea, at the first commercial plant to use the OMEGA technology. Significantly, the owner and operator of the plant is not Shell Chemicals but Korea's Lotte Petrochemicals Company, which has licensed the new technology.

"The reality is that no single producer can build and operate all the projects that are necessary to meet current and predicted demand growth for MEG," says Bill Rothwell, Shell Global Solutions Vice President Innovation & Chemicals Technology. "Licensing is an important element of the way we leverage the Shell Group's strengths in ethylene oxide/glycols (EO/G) process and catalysis technology.

"On average the market supports a new world scale plant every year at the current growth rates. By selectively licensing the OMEGA technology we believe it will have a leading role to play in future investments, both by Shell and other producers, that are key to meeting global demand.

"Licensing can strengthen your technology position and generate demand for associated products and services, including catalysts and process design packages, in which Shell has leading expertise.

CRI Catalyst, a Shell Group company, is the world's leading provider of EO catalysts and support. Shell Global Solutions, the Group's Downstream technology division, provides technical services for plant design, processes and start up.

Licensing can also help build demand for new products, or to establish a foothold in a new market. The licensing of Shell's polytrimethylene terephthalate (PTT) polymer technology, which offers carpet and textiles producers a viable alternative to nylon and polyester, also drives demand for Shell's chemical building block, propanediol or PDO (see next page).

Iain Lo, Shell Chemicals Vice President New Business Development and Ventures, says technology is also an important component of the offering the Shell Group brings to partners and resource holders in joint venture projects. "Our world-class styrene monomer/propylene oxide (SM/PO) technology, for instance, is licensed by joint ventures operating in Singapore, China and The Netherlands.

"It will also be key to future growth projects, through licence agreements with co-investment partners."

The OMEGA technology employed by Lotte Daesan's new 400 kt MEG plant in Korea (left) was developed over many years. The pilot plant at the Shell laboratories (below) will be used to develop further process improvements.

INDUSTRY LEADERS

Shell and CRI Catalyst have been regarded as industry leaders in EO/G process and catalyst technology for nearly 50 years. In that time licences have been issued for 73 EO/G plants globally, 43 of which are still operating. Today, over 37% of the world's EO is produced in Shell-licensed and designed plants and 55% is made using CRI's catalysts.

With a significant portion of EO globally being turned into MEG, there has been a continuous drive to maximise the yield from this conversion. The Shell OMEGA technology achieves a conversion efficiency of over 99% compared to around 90% for conventional processes.

While Shell's conventional MASTER technology employed in many of today's existing EO/G plants uses a catalyst to convert ethylene and oxygen into EO, followed by a thermal reaction to form glycols, OMEGA is entirely catalytic.

It is the result of the successful marriage of two complementary and highly selective processes - Shell's MASTER EO process and a catalytic MEG conversion process originally developed by Mitsubishi Chemical. Shell acquired exclusive rights to the Mitsubishi technology in 2002 and integrated it with its own high selectivity catalytic EO process.

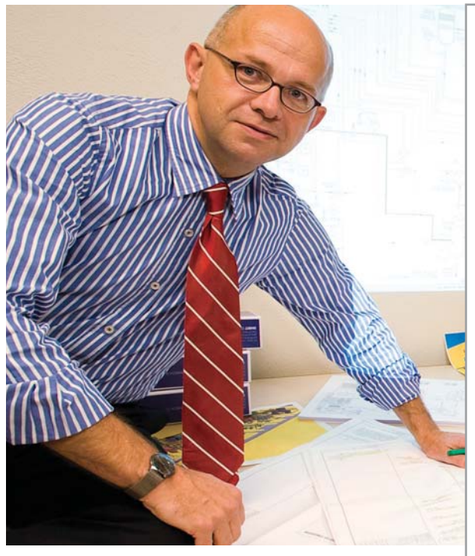
For every tonne of ethylene, OMEGA can produce up to 1.95 tonnes of MEG, compared to 1.53 to 1.70 tonnes produced via a conventional process, depending on the EO catalyst used. With OMEGA by-product yields of diethylene glycol (DEG) and triethylene glycol (TEG) derivatives are negligible, removing the need for the infrastructure and resources to handle and market these products.

Additional benefits include lower capital cost, at equal MEG yield, lower water and steam consumption, at equal EO catalyst selectivity, and less waste water.

FIRST OF ITS KIND

The start-up of the 400 kt OMEGA plant in Daesan, Korea was a considerable success. "The fact that the Lotte plant is the first of its kind and yet was started up within a week of its scheduled date is a major achievement and the culmination of considerable research and development over many years," says Rothwell.

Hokyung Lee, Project Manager of Lotte Petrochemical Company, says: "The fast and smooth start up reflects the excellent preparation by Lotte Daesan Petrochemical and Shell for this project and demonstrates Lotte's commitment to exploiting leading technology at our operations." →



DESIGN FOR A SMOOTH STARTUP

EO/G Design Group Leader, Arthur Rots (left), travelled to Korea earlier this year for the seven-week start up process for the Lotte Daesan OMEGA plant. He led a 12-strong team from Shell Global Solutions, Shell Chemicals, CRI Catalyst and Mitsubishi Chemical.

Although a veteran of EO/G plant design and start up, Rots says the team were well aware of the global industry interest in the project and the pressure to bring the plant onstream successfully.

"In terms of start up, the biggest technical difference between OMEGA and Shell's MASTER process is the number of recycles in the process. It's also more complicated because you also have to accommodate two feeds to the glycols unit – CO_2 and EO – which at start up are not in balanced supply."

The first four weeks in Korea were spent doing pre-startup checks on all the plant systems. "We run the plant on water, nitrogen and CO_2 first, which brings any hidden process issues to the surface. Then we can deal with them before introducing feedstock."

Thanks to careful preparation the plant was producing on-spec product within two days of the full start up, and running at full load within five. The final task was to run checks for the quality, capacity and selectivity guarantees that are a key element of the OMEGA licensing package. "The plant passed all these tests and its selectivity was comfortably above the guarantee level," says Rots.

He and his team will continue to monitor the Lotte plant but have since also travelled to Saudi Arabia to run pre-start up checks for the second OMEGA plant start up for PetroRabigh.

FIBRES POLYMER TECHNOLOGY WITH LICENCE TO STRETCH OUT

Asia's demand for textiles, a driving force in polyester growth, could open up licensing opportunities for another Shell process technology.

Polytrimethylene terephthalate (PTT) is a fibres polymer produced by the reaction of purified terephthalic acid and propanediol (PDO). Fibres made with PTT combine the best properties of nylon and polyester at competitive price levels.

Customers of the first Shell PTT technology licensee are also finding some key application advantages. Textiles made with PTT fibres have a soft feel, excellent drape and comfortable stretch qualities, and can be used to create the latest 'memory' fashion fabrics.

The PTT process was developed in conjunction with Lurgi Zimmer AG, a specialist in polyester plant design. This followed a breakthrough by Shell for making low-cost, high purity, commercial volumes of PDO.

The world's first commercial scale PTT plant was established through a Shell joint venture in Canada and, following several years of successful production, interest in licensing the process is now growing.

"Asia's textile industry is always looking for alternatives to nylon because of its reliance on aromatic feedstocks," says Len Gerlowski, PDO/PTT Strategy Manager.

"With its performance qualities and cost structure PTT has the potential to grow to an equal market size, with the assurance of a secure and competitive supply of raw material.

"A big attraction of the PTT process is that it can be applied to new plants or retro-fitted to existing PET facilities with under-utilised capacity." He adds that supply agreements with Shell and other PDO producers will be essential to the success of PTT converters.

As well as process design and engineering packages, Shell Global Solutions provides operator training, plant inspection and start up support as part of an OMEGA licence agreement.

EO/G Design Group Leader Arthur Rots, who led the Lotte plant start up team, admits to being impressed by the speed and success of the construction and start up (see previous page). "To get a plant up and running in 29 months is very fast, even by Korean standards. The purity and yield achieved from the start were even better than expected," he says.

PROSPECTIVE LICENSEES

To date, five OMEGA licences have been granted and the success of the Lotte plant start up is expected to generate more enquiries.

"This is the first opportunity for those prospective licensees to see the process working on a commercial scale," says Piet Van den Berg, Licensing Manager for Shell Global Solutions.

"When you consider that a world-scale glycols plant represents an investment of around $300 million, it's important to demonstrate its commercial viability.

"Lotte Daesan's parent company, Honam Petrochemicals, has a long history with Shell and already had three MASTER process licences running," he says.

"They shared our confidence in the new technology and were prepared to make the first project investment."

Jan Keijsper, Regional Manager EO/G Technology - "we have ideas for making the OMEGA process even more competitive".

Another OMEGA plant, owned by PetroRabigh – a Saudi Aramco-Sumitomo Chemical joint venture in Saudi Arabia – is expected to start up in early 2009.

That will be followed by Shell's own OMEGA-based 750,000 tonnes per annum facility under construction in Singapore (see page 8), and expected to come onstream in 2009/10. It will be the world's largest OMEGA plant.

While enjoying the current success of OMEGA, Shell Global Solutions is not standing still. In 2006 an OMEGA pilot plant was commissioned at the Shell laboratories in Amsterdam, which has a key role to play in the improvement and further development of the process.

"Our aim is to make sure we are still number one in EO/G technology in 10 years time," says Jan Keijsper, Regional Manager for EO/G technology.

"We have ideas to make the process even more competitive. The pilot plant is a vehicle for further process improvement and will also be used to provide technical support to OMEGA licensees."

For more information on Shell Chemicals technology visit:
shell.com/chemicals/technology