

Best in class: Evonik develops the most efficient process for manufacturing methyl methacrylate

- An intelligent combination of established process steps and new developments leads to an entirely new technology
- Excellent yields, low energy requirements, significantly reduced volumes of wastewater
- Continuous operation of a pilot plant in Darmstadt has demonstrated outstanding product quality

Essen/Darmstadt, Germany. Evonik is currently working on the development of a unique process for producing methyl methacrylate (MMA), an important precursor for PLEXIGLAS® and for specialty applications such as contact lenses and adhesives. Evonik engineers have named the technology LiMA, an acronym that reflects their ambitions: LiMA stands for Leading in Methacrylates. “The technology sets new standards for using resources efficiently and for making notable reductions in its environmental impact. In a great many respects, LiMA is the most efficient MMA production technology developed so far,” says Steffen Krill, the head of Methacrylates Innovation Management at Evonik.

The process is currently being tested at a pilot plant in Darmstadt. Initial results have already shown the quality of MMA to be excellent. “The product can be used for optical applications without limitations—and that’s traditionally one of the most demanding applications for engineering-grade plastics,” Krill explains.

To create LiMA, Evonik combined individual established process steps with newly developed process designs, resulting in an overall new production route. Intelligent process set-up and control and a highly efficient new catalyst result in final product yields exceeding 90 percent. Because it uses considerably less energy, the process also reduces carbon dioxide emissions by up to 40 percent. The overall favorable process design as well as moderate reaction conditions minimize wastewater streams, engineering work, and maintenance needs. Another advantage of the technology is its use of petrochemical raw materials, which are readily available throughout the world.

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LiMA begins with ethylene and methanol. These then undergo multiple reaction steps to produce methacrolein. The key to the new process is the conversion of methacrolein to methyl methacrylate in a single step. Evonik achieved this by developing a brand-new catalyst system. The method is carried out entirely in the liquid phase and under moderate conditions, with temperatures generally well below 100 degrees Celsius.

The new catalyst system is remarkably robust and highly efficient. In other catalysts, individual components of the catalyst are gradually lost from the carrier with reaction time, but this phenomenon—known as bleeding—hardly occurs with LiMA catalysts. A unique combination of metal oxides and a special preparation procedure gives the catalyst its unusual stability. By-products and catalyst poisons are efficiently removed during preliminary process stages.

The new process completes the MMA technology portfolio of Evonik. The company is one of the world's leading providers of methacrylate monomers, including MMA. At its production sites on three continents, Evonik is capable of manufacturing roughly 600,000 metric tons of methacrylate monomers. In the industry, MMA is currently made in a variety of processes depending on the region and the availability of raw materials. What is known as the C3 technology is the most widely used process. The raw material used here is acetone, and its three carbon atoms are what give the technology its name. Isobutene, which has four carbon atoms, is the basis for the C4 process. Its use of ethylene as a starting material makes LiMA a C2-based technology.

Typical applications of MMA include PLEXIGLAS® engineering-grade plastic, as well as finishes, floor coatings, adhesives, and dental products. PLEXIGLAS® molding compounds are particularly useful in the automotive and lighting industries for executing effective design ideas. Its outstanding properties also make this material suitable for use in medical technology and in optical applications. PLEXIGLAS® can be found in many other areas of daily life as well, such as household products. Methacrylate monomers marketed under the brand name VISIOMER® lend a

brilliant shine, scratch resistance, and long service life to automotive coatings. Methacrylates are likewise indispensable in the production of contact lenses, personal hygiene products, and dental prostheses.

About Evonik

Evonik is one of the world leaders in specialty chemicals. The focus on more specialty businesses, customer-orientated innovative prowess and a trustful and performance-oriented corporate culture form the heart of Evonik's corporate strategy. They are the lever for profitable growth and a sustained increase in the value of the company. Evonik benefits specifically from its customer proximity and leading market positions. Evonik is active in over 100 countries around the world with more than 35,000 employees. In fiscal 2016, the enterprise generated sales of around €12.7 billion and an operating profit (adjusted EBITDA) of about €2.165 billion.

About Performance Materials

The Performance Materials Segment is managed by Evonik Performance Materials GmbH. The segment focuses its global activities on developing and manufacturing polymer materials and intermediates, especially for use in agriculture and in the rubber and plastics industry. In 2016, the segment's roughly 4,400 employees generated sales about €3.2 billion.

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