

Evonik and LIKAT achieve breakthrough in carbonylation chemistry

- Realization of a "Dream Reaction": First direct carbonylation of 1,3-butadiene successful
- This paves the way for the development of more cost-effective and environmentally friendly industrially important adipic acid derivatives
- Success through cooperation with Leibniz-Institute for Catalysis
- Special recognition through first-time publication of Evonik in renowned journal "Science"

A research team with leading participation of Evonik has achieved a breakthrough in the field of carbonylation chemistry. Carbonylation is one of the most important types of reaction in the chemical industry. It involves the catalyzed introduction of a CO group (carbonyl group) into organic compounds. For more than 60 years, science and industry had been looking for a way to implement the now successful reaction step.

A team was led by Prof. Dr. Matthias Beller, Director of the Leibniz Institute for Catalysis, Rostock, and Prof. Dr. Robert Franke, Evonik Performance Materials GmbH. The scientists have succeeded in double carbonylating the starting material 1,3-butadiene directly to produce adipates (salts of adipic acid). Adipates can currently only be produced by a complex multi-stage, energy- and cost-intensive synthesis. This involves not only the use of many chemicals, but also releases climate-relevant nitrogen oxides (NO_x), which are among the main greenhouse gases.

The potential benefits from this innovation are great: adipates are produced annually on a large scale in the millions of tonnes and serve as starting materials for the manufacture of numerous products such as plasticizers, perfumes, lubricants, solvents, various active pharmaceutical ingredients and above all nylon.

With their new process, the participating project partners are laying the foundation for a more environmentally friendly and cost-effective large-scale method of synthesis.

January 6, 2019

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The key to the breakthrough Development of a new palladium catalyst based on a specific phosphine ligand (HeMaRaPhos). This ligand binds to palladium, resulting in a highly selective, efficient and long-lived catalyst that can result in 95% yields of adipic acid derivatives under industrially feasible conditions.

Due to the special importance of this innovation, the renowned journal “Science” published the results of the project <https://science.sciencemag.org/content/sci/366/6472/1514.full.pdf>.

What's the next step? The large-scale evaluation of economic and technical aspects will start right away.

Company information

Evonik is one of the world leaders in specialty chemicals. The focus on more specialty businesses, customer-oriented 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. In fiscal 2018, the enterprise with more than 32,000 employees generated sales of €13.3 billion and an operating profit (adjusted EBITDA) of €2.15 billion from continuing operations.

About Performance Materials

The Performance Materials Segment is managed by Evonik Performance Materials GmbH. The segment focuses its global activities on developing and manufacturing intermediates, solutions and additives, especially for use in agriculture and in the rubber and plastics industry. In 2018, the segment’s roughly 1,700 employees generated sales about €2.39 billion from continuing operations.

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