

CO₂ as a raw material: new process makes climate gas usable for the chemical industry

- Environmentally friendly alternative to conventional ester production
- CO₂ and green hydrogen replace fossil feedstocks
- Successful collaboration between LIKAT, Ruhr University Bochum and Evonik

Rostock/Bochum/Marl, Germany. Researchers from the Leibniz Institute for Catalysis (LIKAT), Ruhr University Bochum and Evonik Oxeno have developed a novel catalyst system that enables the use of the climate gas carbon dioxide (CO₂) as a raw material for the chemical industry. This breakthrough allows for the more sustainable production of key products such as fragrances and building blocks for plastics.

“Directly using CO₂ as a feedstock is a milestone for sustainable chemistry on an industrial scale,” says Prof. Dr. Robert Franke, Project Leader at Evonik Oxeno. “Our collaboration with LIKAT and Ruhr University Bochum demonstrates how excellent fundamental research combined with industrial expertise can lead to innovative solutions for transforming the chemical industry.”

Carbonylation is a central process in chemical manufacturing, in which olefins – a group of hydrocarbons – are converted into esters or acids using carbon monoxide. These substances are essential components of many everyday products. The process yields both basic chemicals – such as methyl methacrylate, the precursor for acrylic glass – and specialty chemicals like the fragrance valeric acid methyl ester.

The newly developed bimetallic catalyst system replaces toxic carbon monoxide with climate-friendly carbon dioxide and green hydrogen. In the presence of the transition metals iridium and palladium, along with a proven industrial phosphine ligand, olefins are directly converted into esters. The system shows high selectivity for linear products, which are particularly valued in industrial applications.

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“This catalyst system is a great example of how targeted research can contribute to the defossilization of the chemical industry. CO₂ is no longer seen as waste, but as a valuable resource,” says Dr. Ralf Jackstell, Head of Research Group at LIKAT.

This opens up a new perspective: producing industrially relevant chemicals directly from climate gas CO₂ and green hydrogen in a resource-efficient way. The results have been published in the renowned journal *Journal of the American Chemical Society*.
<https://pubs.acs.org/doi/10.1021/jacs.5c09325>

Evonik: Leading beyond chemistry

Evonik goes beyond the boundaries of chemistry with its combination of innovative strength and leading technological expertise. The global chemical company, headquartered in Essen, Germany, is active in more than 100 countries and generated sales of €15.2 billion and earnings (adjusted EBITDA) of €2.1 billion in 2024. The common motivation of the approximately 32,000 employees: to provide customers with a decisive competitive advantage with tailor-made products and solutions as a superforce for industry, thereby improving people's lives. In all markets. Every day.

About Evonik Oxeno

Evonik Oxeno, a wholly-owned subsidiary of Evonik, is a leading company in C4 chemistry with 50 years of experience, operating two world-scale C4 production facilities in Marl and Antwerp. The flexibility of its integrated network allows Oxeno to quickly and efficiently respond to changing conditions in supply and demand, optimizing the complexity of value chains also for its suppliers and customers. Oxeno is recognized for its focus on innovation and sustainability, maintaining an impressive portfolio of approximately 2,500 patents and patent applications. Its C4 strategy is based on a solid foundation and defined measures for growth and transformation. The company's vision, “Chemistry4Future® – We increase the value of C4 chemicals sustainably,” outlines its long-term goal and provides a clear idea of where it aims to see its business in the future.

About the Leibniz Institute for Catalysis (LIKAT Rostock)

The Leibniz Institute for Catalysis (LIKAT) in Rostock is one of the largest publicly funded research institutes for applied catalysis. Around 300 employees develop innovative catalysts and sustainable processes for chemistry, energy and the environment. As a member of the Leibniz Association, LIKAT conducts socially relevant research and covers the entire process from basic science to industrial application. In doing so, it contributes to conserving resources and accelerating the transition to a climate-neutral economy.

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