

Evonik demonstrates for the first time that SILP catalyst systems can be used commercially

- Production of important chemical input materials can be even more resource conserving
- SILP catalyst systems prove their capability in a pilot plant for hydroformylation
- Considerably extended service life of 2,000 hours

Evonik Industries demonstrated for the first time in a pilot plant that innovative SILP catalyst systems can work reliably for about 2,000 hours. The high service life is important proof that these economically and ecologically interesting catalyst systems can be used on an industrial scale. SILP stands for Supported Ionic Liquid Phase and describes a technology with which homogeneous catalysts can be applied to solid materials, such as silicon oxides or aluminum oxide, with the help of ionic liquids.

Scientists used the new catalyst systems in hydroformylation, an industrially important reaction that is used in the chemical industry to recover aldehydes from olefins and syngas. Among other things, aldehydes are a precursor for plasticizer alcohols; Evonik is the largest producer of C9/C10 plasticizer alcohols in Europe. Prof. Robert Franke, who is responsible for Innovation Management Hydroformylation in Evonik's Performance Materials Segment says, "With our research work, and especially in connection with Process Technology & Engineering, we are increasing our technology lead and making an important contribution towards keeping our integrated technology platforms and efficient processes effective."

These days, in commercial hydroformylation only homogeneous catalysts are used as highly efficient reaction accelerators. Plus points for homogeneous catalysts are their high level of selectivity and activity at low temperatures. However, since they are dissolved in the reaction mixture, after the reaction they have to be separated and recycled, which requires a lot of effort. With heterogeneous catalysts that are available as solids, this is simpler.

The new SILP catalyst systems combine the advantages of homogeneous and heterogeneous catalysts. While looking for suitable SILP catalyst systems for hydroformylation, over the last

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four years Evonik, together with the University of Erlangen–Nuremberg and Darmstadt University of Technology, was involved in the HY–SILP project sponsored by the German Federal Ministry of Education and Research, BMBF (project number: 01RC1107A).

Franke says, “The frontrunner was a rhodium complex with one ligand based on a polycyclic anthracenetriol structure. The ionic liquid consists of an imidazolium cation and an anion based on a binary amine.” In the tests, this SILP catalyst exhibited long-term stability of more than 2,000 hours. Franke continues, “Hence, based on the published technology to date, our team was able for the first time to develop a SILP system with a degree of stability that is interesting for a technical process such as hydroformylation.”

Simulation of commercial hydroformylation with an additional integrated SILP catalyst system also reduced carbon dioxide by a good two percent compared to Evonik's process with a homogeneous catalyst, which is already quite efficient. Franke summarizes, “On the whole, the SILP catalyst produces good results, even if we are aiming to reduce CO₂ even more. Several other issues still have to be clarified before this system can be used in a commercial plant: especially, we are looking for ligands that further increase the yield from hydroformylation and that also have even better service times.”

More information can be found in the science newsletter elements 51. www.evonik.com/elements

Company information

Evonik, the creative industrial group from Germany, is one of the world leaders in specialty chemicals. Profitable growth and a sustained increase in the value of the company form the heart of Evonik's corporate strategy. Its activities focus on the key megatrends health, nutrition, resource efficiency and globalization. Evonik benefits specifically from its innovative prowess and integrated technology platforms.

Evonik is active in over 100 countries around the world. In fiscal 2014 more than 33,000 employees generated sales of around €12.9 billion and an operating profit (adjusted EBITDA) of about €1.9 billion.

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