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Anaerobic Epoxidation of Ethylene

Safe, efficient ethylene oxide production

Researchers in the Department of Engineering and the Department of Chemical Engineering, University of Cambridge, have developed a new catalyst and process for the generation of ethylene oxide from ethene which removes the need for purified air, showing a potential new route to more efficient and safer ethylene oxide production. The team is now keen to find suitable partners for upscaling and development.

Professor John Dennis is the Head of the Chemical Engineering and Biotechnology Department in Cambridge. His research focuses on fluidised bed reactors for the sustainable generation of energy by gasification and combustion.

Benefits for small users

- Lowers the risk of explosive mixtures so the process is safer
- May allow for point-of-use production and reduce the need for transportation

Benefits for large producers

- Efficient process with 40% conversion in one single cycle
- Less recycle compression and separation
- No need to separate N_2 or purify O_2

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The Improved Process

The new technology uses a chemical looping system with a packed bed reactor and a novel catalyst, which is key to this process. The novel catalyst acts as a solid source of oxygen, meaning there is no need for purified air or oxygen to be added to the system during the production of ethylene oxide. This lowers the risk of explosive mixtures forming and will allow the design of a more efficient process where more ethylene oxide is produced per cycle, with good selectivity. A schematic of the process is shown in Figure 1.

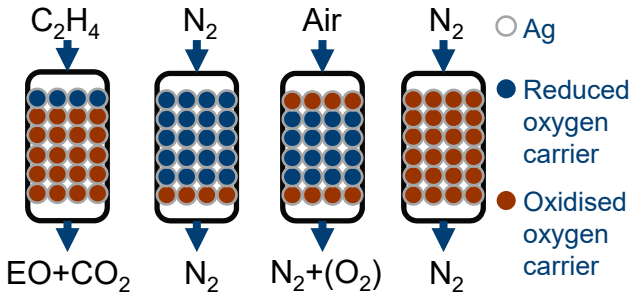

Figure 1: Schematic of the chemical looping process

Applications

Our new process has applications for small users and large producers of ethylene oxide. The process could be designed so small plants to can run at, or close to, the site of small users, which has previously been unfeasible due to safety issues. The transport of ethylene oxide is problematic so allowing the production of small amounts closer to where it will be used overcomes the issues with transport.

For larger producers of ethylene oxide, the capital cost of air separation units in large established plants is a key concern in this cost-sensitive industry, and our process removes the need for such expensive units.

This technology could also be used to circumvent the need for ethene for large scale ethylene oxide production where natural gas is not available, for example, by using ethanol as a feedstock instead.

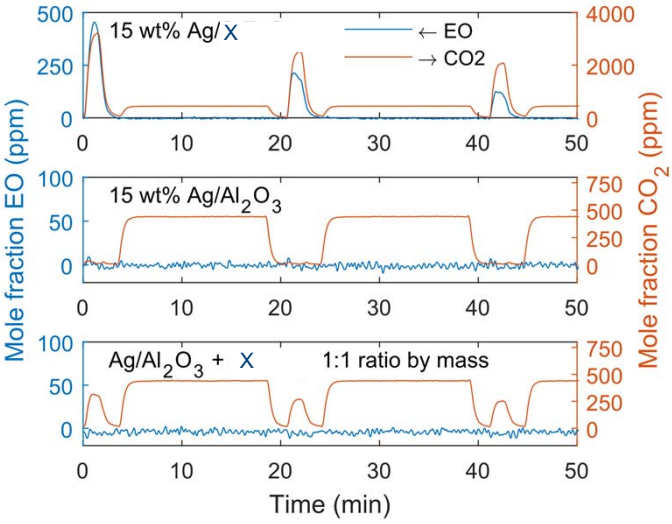

Figure 2: Concentration profiles from a packed bed reactor operated in chemical looping mode with our novel silver catalyst (correctly formulated) showing ethylene oxide production (top), followed by two negative controls showing no ethylene oxide production, silver on an inert support (middle) and an unformulated catalyst/silver mixture on an inert support (bottom).

Next steps

This technology is protected by a patent application. We are now looking for partners to help us develop and scale-up the process for ethylene oxide. Please contact us to explore this opportunity further.