The Rheticus Project

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Abstract

Profitable renewable synthesis of chemicals and fuels is a prerequisite for its implementation into current economics. Availability of renewable energy in sufficient quantities and its intermittent character is the main condition. To achieve profitability in a very low fossil energy price scenario Rheticus opens the opportunity to move stepwise into different markets starting from speciality products.

The presented industrial process consists of two major components: Firstly, electricity from wind or solar is stored by electrolysis into energy carriers like hydrogen (H_2) or carbon monoxide (CO). Current density, Faradaic and electrical efficiency and endurance of this upstream process will be discussed. Secondly downstream, a flexible mixture of CO, CO_2 and H_2 is supplied to a multistep anaerobic fermentation process, whereas they are initially converted to acetic acid and ethanol with high carbon efficiency and thus almost without any undesired by-products. The todays economic value is obtained by further condensation of the C_2products to C_4 and C_6 special chemicals (carboxylates and alcohols). Eventually, finally scaled into the hundreds megawatt range the molecules can be used as fuels.

In the talk a potential solution is addressed by using a commercially available silver-based gas diffusion electrode (used in industrial-scale chlorine–alkaline electrolysis) as the cathode in the CO_2 electrolyser. Electric current densities up to 300 mA cm² were demonstrated for more than 1,200 hours with continuous operation. Faradaic efficiency of the anaerobic fermentation processes was almost quantitative [1].
Evonik and Siemens have decided to move the technology platform toward an industrial scale. The project is named Rheticus [2]. Generally, such an approach is called artificial or technical photosynthesis.

[1] Haas et al. Technical photosynthesis involving CO_2 electrolysis and fermentation;
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[2] https://press.siemens.com/global/en/pressrelease/research-project-rheticus
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