CO2ART - Conversion of CO2 to sustainable ARomatics applying innovative reactor Technology

Publieke samenvatting / Public summary

Aanleiding

The chemical sector faces a radical energy transition. It is important to develop sustainable routes towards chemical products as alternatives to the current fossil-based production routes. Within the chemical sector, aromatic components BTX (benzene, toluene and xylenes) are important base chemicals for production of polymers, solvents, dyes and specialty chemicals. In this CO2ART proposal, an emerging technology route is proposed to support the development of pathways towards sustainable aromatics production: direct conversion of CO2 with sustainable hydrogen in aromatic components using a bifunctional catalyst. The technology development is focused on the improvement of the reaction selectivity and the prevention of catalyst coking of each catalyst component and optimization of the process using an electrically powered, integrated reactor technology.

Doelstelling

The necessity to reduce the use of fossil raw materials and eventually eliminate them, is essential for a sustainable (future) society. CO2ART aims to develop and demonstrate an efficient technology to produce renewable aromatic building blocks derived from CO2 and hydrogen. Key focus elements to achieve this are the improvement of the reaction selectivity and the prevention of catalyst coking and matching the operational window for the individual parts of the bifunctional catalyst. The technological developments proposed in this project will enhance the performance of the

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Algemene informatie / General information

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overall technology chain, starting from CO2 and H2, up to cost-effective production of sustainable aromatics. Production of CO2 derived aromatics is part of the circular carbon solution which is needed to transform the chemical industry. As such it fits with MMIP6, “sluiting van industriële ketens”, circular plastics and the use of CO2 as feedstock for industrial products, reducing the need for fossil feedstock.

Korte omschrijving

The consortium is in a unique position to advance the technology level of novel reactor technology, as part of the technology chain of carbon dioxide (CO2) and hydrogen (H2) to sustainable aromatics. The activities are organized in four work packages: WP1 – Use case definition This WP focusses on a description of how the to-be developed reactor concept will be integrated in future technology and value chains. WP2 – Technology development This WP focusses on the development of improved catalyst systems and evaluation and optimization of the process conditions. Sample materials produced will be evaluated. WP3 – Business case In this WP both the engineering design and a conceptual process will be developed as input for a techno-economic evaluation and first assessment of overall sustainability. WP4 – Gap analysis and technology roadmap Based on, amongst others, the results of the techno-economic analysis, current technology gaps are identified and a technology roadmap will be created to map the required technical steps after finishing the project.

Resultaat

Within the project the following technical results will be achieved. Firstly, a novel catalytic reactor concept will be advanced to TRL4 with a focus on improved catalytic materials with less deactivation issues and selectivity and integration with sustainable electric heating (WP2) Secondly, the potential of the production chain and the potential improvement with the novel technology are explored in a techno-economic analysis (WP3). Thirdly, current technology gaps are determined at the end of the project and a technology roadmap is

produced for future technology development (WP4). In addition, results after completing the project include: - Increase of the technology readiness level of a novel reactor concept as part of the technology chain from CO2 and H2 to sustainable aromatics from TRL2 to TRL4. - Business Case based on Techno-economic Evaluations and a CO2 footprint assessment as part of an Initial Life-cycle assessment

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.
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