Sustainable Production of Carbon-Based Raw Materials for the Chemical Industry by Power-to-X Technologies

Müller, T.
Ruhr-Universität Bochum

Abstract

Fossil resources are currently the primary feedstock for the production of base chemicals and intermediate products in the chemical industry. Despite efforts to decarbonize the value chain, there will be a continued need for carbon-based products, since hydrocarbons and other carbon-containing molecules and materials have expedient properties that cannot be replaced easily [1].

Power-to-X technologies [2] are considered to provide promising opportunities for a sustainable production of base chemicals and intermediate products that are at the heart of the chemical industry. The closure of forthcoming sustainable value chains and establishing anthropogenic carbon cycles will need to be based on sustainable industrial and natural sources as carbon feedstock, and renewable energies for providing the necessary energy for driving endothermal chemical transformations and for supplying the required process energy.

Many chemical compounds that are accessible by Power-to-X technologies are more readily transported and stored compared to the electricity produced initially by exploiting the renewable primary energy source. Implementing Power-to-X concepts provides new opportunities for making sustainable chemical entities available as feedstock for the chemical industry. In this context, hydrogen may provide a central link between the energy sector and the molecular and material world [3].

[1] P. Tomkins, T. E. Müller; Evaluating the carbon inventory, carbon fluxes and carbon cycles for a long-term sustainable world; Green Chemistry 21-15 (2020) 3994.
[2] M. Hermesmann, K. Grübel, L. Scherotzki, T. E. Müller; Promising pathways: The Geographic and Energetic Potential of Power-to-X Technologies Based on Regeneratively Obtained Hydrogen; Renewable and Sustainable Energy Reviews 138 (2021) 110644.
[3] M. Hermesmann, T. E. Müller; Green, Turquoise, Blue, or Grey? Environmentally friendly Hydrogen Production in Transforming Energy Systems, PECS 90 (2022) 100996.