

Fossil-free polycarbonate polyols from captured carbon dioxide and renewable hydrogen

J. Lehtonen¹, J. Kärkö²,

1 VTT Technical Research Centre of Finland Ltd, Espoo, Finland

2 VTT Technical Research Centre of Finland Ltd, Jyväskylä, Finland

Carbon dioxide has recently been used as feedstock to produce high-quality polymers, such as flexible polyurethane foams¹. So far, only approximately 20 % of the feedstock has been CO₂ while the rest is fossil-based epoxides. Due to large market volumes of these polymers, millions of tons of CO₂ could be utilized annually on a global scale.

VTT is developing a concept (Figure 1) where polycarbonate polyols are produced from CO₂ and renewable power. CO₂ captured from industrial sources, hydrogen obtained from water electrolysis or as a by-product from the industry are converted into olefinic hydrocarbons in a two-step process. First carbon monoxide is produced by a combination of reverse water-gas shift (rWGS) reaction and catalytic partial oxidation (CPOX). Then carbon monoxide and hydrogen are converted to hydrocarbons by Fischer-Tropsch synthesis using a proprietary Fe-based catalyst leading to a high yield (> 45 %) of light olefins. The produced light olefins (C₂-C₄) are further oxidized into epoxides using hydrogen peroxide and the obtained mixture of epoxides is co-polymerized with CO₂ and a starter polyol into polycarbonate polyols to applied for polyurethanes.

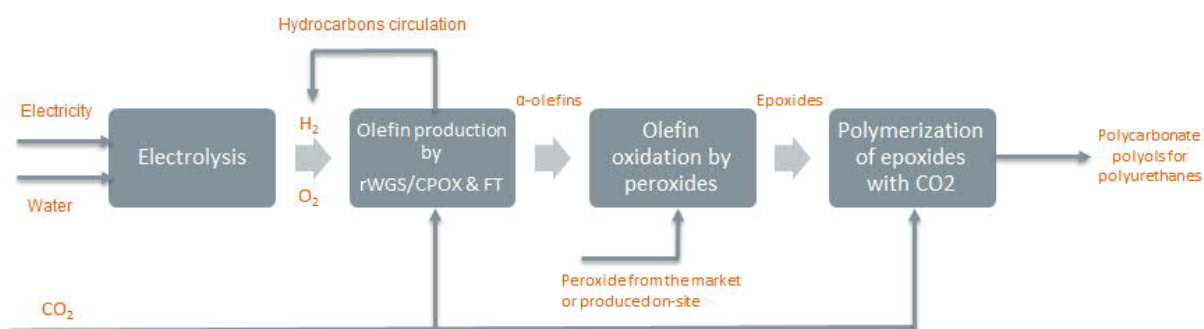


Figure 1. Our concept from CO₂ and electricity to polycarbonate polyols.

Our presentation will cover plans and preliminary results from an on-going joint project with Finnish industry consortium.

¹ <https://www.co2-dreams.covestro.com/en>, accessed 30.01.2019