

Paired Flow Electrolyzers for Furanic Compounds Conversion to Valuable Chemicals

Hengzhou Liu¹, Ting-Han Lee¹, Eric W Cochran¹ and Wenzhen Li¹

Chemical & Biological Engineering, Iowa State University, Ames, IA, USA 50011

Abstract:

Paired electrolysis has been emerged as an electricity-powered platform for converting biorenewable feedstock to higher-valued chemicals at both the cathode and anode. In this presentation, we explored paired electrolyzers of different architectures with remarkable performance and stability. We first designed three-electrode flow electrolyzers to pair electrocatalytic hydrogenation of 5-(hydroxymethyl)furfural (HMF) on oxide-derived silver electrode and TEMPO-mediated HMF oxidation on carbon cloth. The paired flow cell achieved a combined faradaic efficiency of 163% to desired 2,5-bis(hydroxymethyl)furan (BHMF) and 2,5-furandicarboxylic acid (FDCA) with a cell potential of ~ 1.7 V, at the constant current of 10 mA. When the anodic reaction was replaced by hydrogen oxidation, a minimized cell voltage of only ~ 0.9 V was achieved. We then assembled a membrane electrode assembly (MEA)-based two-electrode flow cell, which realized a minimized cell potential of only ~ 1.5 V for a continuous 24 hours paired electrolysis of HMF. Finally, a pH asymmetric architecture was designed to match the optimum reaction conditions and to replace HMF oxidation on a NiFeOOH anode catalyst without a redox mediator. Our recent development of electrochemical-chemical combined reactors for furanic compounds conversion will also be briefly presented.