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Enrichment of H₂ to CO₂ ratio using formic acid as a hydrogen carrier (Abstract)

CRADA 581 (PNNL 80835, 80836)

June 2023

Thomas Autrey

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Pacific Northwest National Laboratory
Richland, Washington 99354

Abstract

The collaboration between PNNL and OCOchem will investigate approaches to enhance the hydrogen (H₂) content from a stream of H₂ and carbon dioxide (CO₂) gases produced in the catalytic decomposition of aqueous formic acid (FA85). OCOchem uses an electrochemical process to generate FA85 from captured CO₂ using electricity from renewable resources. The FA85 is a liquid organic hydrogen carrier (LOHC) that provides the opportunity to transport and store hydrogen, in liquid form, at volumetric densities significantly greater than compressed H₂ gas, i.e., 50 grams H₂/liter FA. PNNL has developed and tested catalytic reactors to release H₂ from LOHCs like FA and aqueous formate salts (FS). The H₂ released from the LOHC can be oxidized in a proton-exchange membrane fuel cell (PEM-FC) to generate electricity with water as the only by-product. The purpose of the proposed project is to increase the purity of the hydrogen released from the LOHC to enhance the operation efficiency of the PEM FC. The PEM FC in combination with the LOHC provides an approach to demonstrate a portable generator that utilizes hydrogen as the energy carrier instead of conventional diesel generator. The 'hydrogen generator' can be used to supply emergency backup power and significantly reduce CO₂ emissions relative to a diesel generator.

Pacific Northwest National Laboratory

902 Battelle Boulevard
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