Title
Electrochemical Hydrogen Compression Cell Design

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Cooperative Research and Development Agreement (CRADA) Final Report

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In accordance with Requirements set forth in the terms of the CRADA, this document is the CRADA Final Report, including a list of Subject Inventions. It is to be forwarded to the DOE Office of Scientific and Technical Information upon completion or termination of the CRADA, as part of the commitment to the public to demonstrate results of federally funded research.

Parties to the Agreement: HyET Hydrogen USA LLC and Lawrence Berkeley Laboratory

CRADA number: FP00006260

CRADA Title: Electrochemical Hydrogen Compression Cell Design

Responsible Technical Contact at Berkeley Lab: Adam Weber

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Sponsoring DOE Program Office(s):
Doe EERE HFTO

LBNL Report Number:
[PI to complete]

OSTI Number:
[SPO to complete]

Joint Work Statement Funding Table showing DOE funding commitment:

DOE Funding to LBNL	0
Participant Funding to LBNL	$2,220,000
Participant In-Kind Contribution Value	$1,200,000
Total of all Contributions	$3,420,000

Provide a list of publications, conference papers, or other public releases of results, developed under this CRADA:
(Publications must include journal name, volume, issue, Digital Object Identifier)
None

Provide a detailed list of all subject inventions, to include patent applications, copyrights, and trademarks:
(Patents and patent applications are to include the title and inventor(s) names. When copyright is asserted, the Government license should be included on the cover page of the Final Report)
None

Executive Summary of CRADA Work:
Electrochemical compression and purification is a high potential technology that is likely to outcompete mechanical compression for hydrogen end use applications. However, testing and understanding what is occurring within the cell is difficult as it is not readily accessible through experimentation. Thus, the main target is to increase performance and reduce cost of electrochemical hydrogen compression (EHC) and purification (EHP) cells and stacks using multiscale mathematical modeling informed by experiment. The models can provide physical insight into limiting processes and develop mitigation methods, which can be proven out through rapid sub-scale testing of the devices.

Summary of Research Results:
As a result of an extensive R&D process, HyET Hydrogen has developed an electrochemical hydrogen compressor with an output of 10kg/day at up to 450 bar. LBNL helped HyET Hydrogen design and subscale test of a modular compressor for 50 kg/day and up to 950 bar. This included a complete multiphysics, transient 2-D cell model for the electrochemical compressor, analysis of various components including gas-diffusion layers, and an upscaling methodology to go from the 2D detailed model to a full-cell model including heterogeneities. LBNL helped HyET Hydrogen design and optimize new compressor architectures for higher throughput, cell area, and/or higher pressure operation. In addition, the use of the compressor and designs for purification of hydrogen and stranded locations was modeled and explored.