NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Testing and Evaluation of Photoelectrochemical Membranes

Cooperative Research and Development Final Report

CRADA Number: CRD-08-313

NREL Technical Contact: Todd Deutsch

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

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Cooperative Research and Development Final Report

In accordance with Requirements set forth in Article XI.A(3) of the CRADA document, this document is the final CRADA report, including a list of Subject Inventions, to be forwarded to the Office of Science and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

CRADA number: CRD-08-313 (WRA8)

CRADA Title: Testing and Evaluation of Photoelectrochemical Membranes

Parties to the Agreement: Synkera Technologies

Joint Work Statement Funding Table showing DOE commitment:

Estimated Costs	NREL Shared Resources
Year 1	$ 00.00
Year 2	$ 00.00
Year 3	$ 00.00
TOTALS	$ 00.00

Abstract of CRADA work:

This research work will be undertaken in close coordination with Synkera Technologies and in concurrence with the overall objectives of the Synkera DOE SBIR Phase II project. The subcontract is conditional on Synkera receiving the DOE Phase II SBIR award.

Summary of Research Results:

NREL characterized electrodes provided by Synkera composed of semiconductor light-absorbing material applied to nanoporous alumina membranes. The semiconductor materials were deposited within the pores of the membranes by atomic layer deposition. NREL used photoelectrochemical characterization techniques to estimate the electrodes' suitability for solar water-splitting applications by determining the band gap, band edge alignment, and ability to generate photocurrent. The electrodes exhibited wide band gaps that led to low photoconversion efficiencies under broadband illumination, even under a high reverse bias. The band edge measurements indicated the potential of the conduction band edge was insufficient to drive water reduction without a bias. Results of stability analysis were non-ideal, evidenced by a decline in photocurrent over a few hours of testing and the propensity for mechanical macroscopic cracking of the membrane electrodes. The materials and geometries tested have no hope for solar-water splitting at a reasonable efficiency.

Subject Inventions listing: None

Report Date: 7/17/2012 **Responsible Technical Contact at Alliance/NREL:** Todd Deutsch

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