Advanced Manufacturing of Gas Diffusion Layers with Highly Engineered Porosity

Phase I SBIR

PI: David Driscoll

RI Lead: Stephen Sofie

June 13, 2018

Glacigen Materials, Inc.
Bozeman, MT

Montana State University
Bozeman, MT

2018 DOE Annual Hydrogen and Fuel Cells Program Annual Merit Review

Project ID FC190

Overview

Timeline and Budget

- Project Start Date: 04/09/2018
- Project End Date: 01/08/2019
- Total Project Budget: $149,637.00
- Total DOE Funds Spent: $0

(As of 3/31/2018)

Barriers

- A. Lack of High-Volume MEA Processes
- C. Lack of High-Strength Gas Diffusion Layers
- C. Performance, Stack Water Management

Partners

- Montana State University
- Montana Manufacturing Extension Center

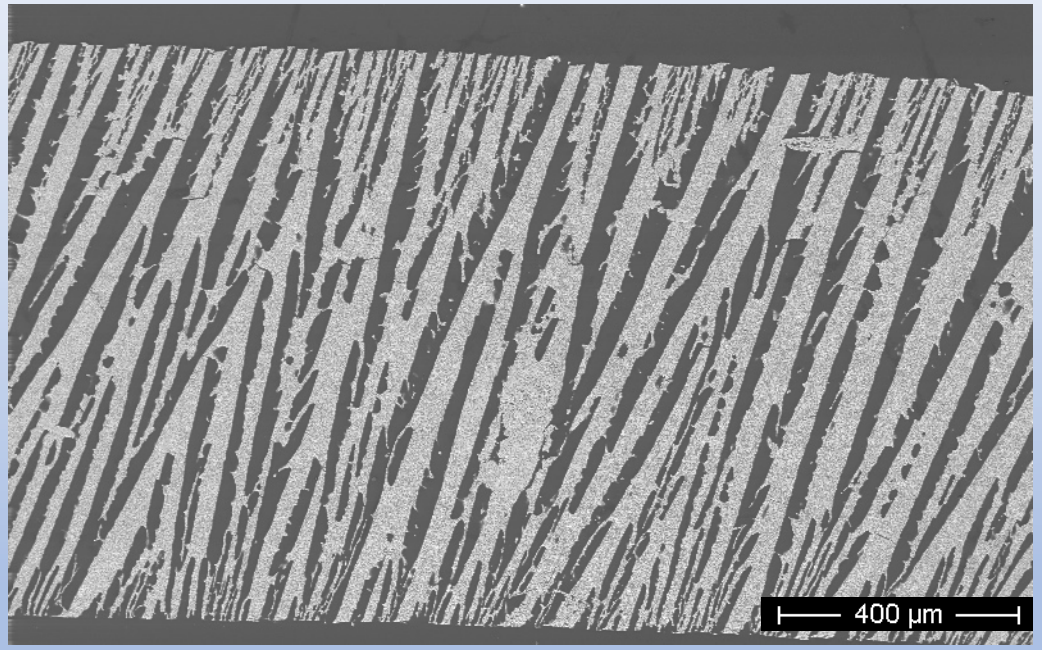
Company Background

- Founded in 2016
- Bozeman, MT
- Company mission of enabling freeze tape casting as an advanced manufacturing technique with utility in a number of applications

Relevance

Objective:

Explore freeze tape casting as a technique to produce a gas diffusion layer with graded porosity to in-turn provide a hydrophobicity gradient.



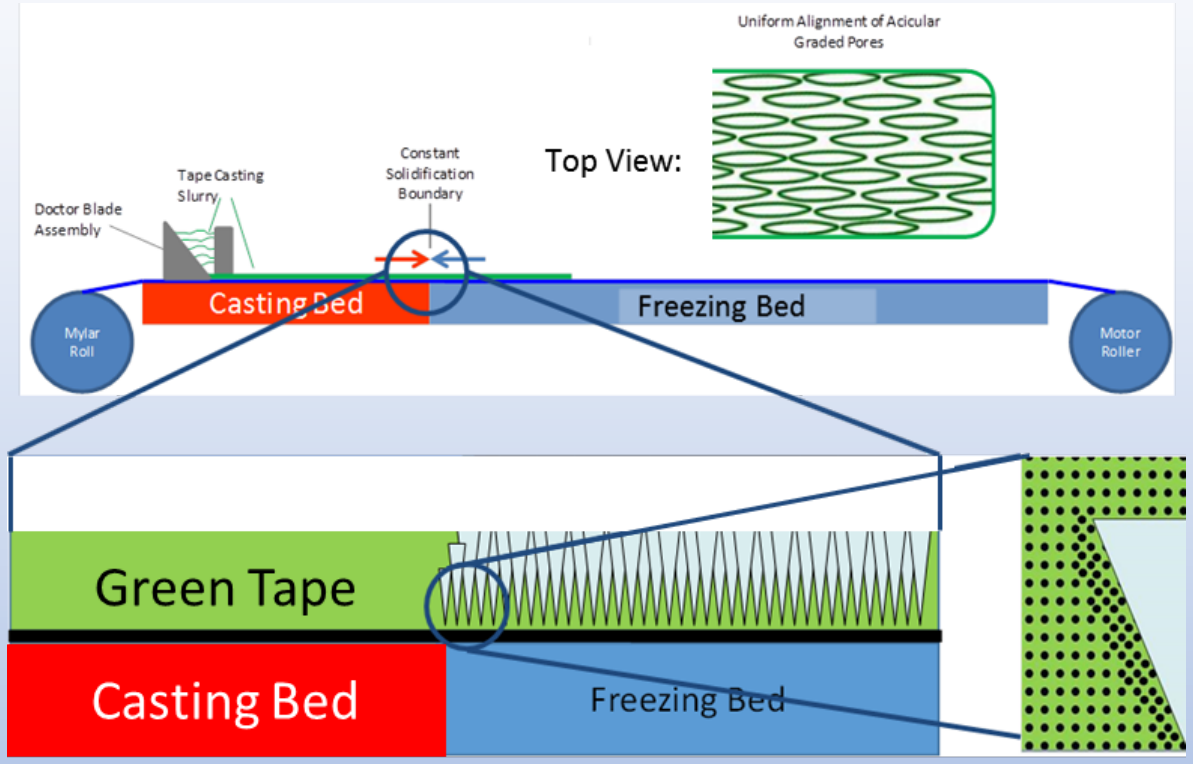
C. Lack of High-Strength Gas Diffusion Layers

C. Performance, Stack Water Management

Less brittle paper gas diffusion layers and stronger woven GDLs are needed. In addition to new approaches to produce stronger gas diffusion media, methods to reduce or eliminate protruding or loose fibers or other materials from the GDL surfaces are needed.

Approach

- Freeze cast Ti-based scaffold. Including slurry development and process parameters.
- Develop appropriate sintering profile.
- Infiltrate graded pore Ti GDL with PTFE using suspension in organic carrier fluid.
- Cell level demonstration.



1. First titanium freeze cast produced. (Month 2)
2. First sintered titanium freeze cast complete. (Month 3)
3. First prototype GDL produced with PTFE treatment. (Month 5)
4. First cell demonstration. (Month 6)

Accomplishments and Progress

- New project as of presentation submission deadline.
- Current updates at time of presentation.
- [Response to Previous Year Reviewer's Comments: N/A]

Collaboration

- Montana State University
  - Relationship: Subcontractor
  - Type: University
  - DOE Hydrogen/FCP: Outside
  - Extent: For this Phase I SBIR, Glacigen has engaged Prof. Stephen Sofie of Montana State University with a subcontract under the award as well as the Montana Manufacturing Extension Center for financial analysis.

- Glacigen is actively working with a number of industrial partners to implement freeze tape cast microstructures in a variety of applications – most notably lithium ion battery electrodes.

Proposed Future Work

- Remainder of Phase I
  - Completion of technical objectives by January 2019.
  - Financial analysis in collaboration with Montana Manufacturing Extension Center (MMEC.)

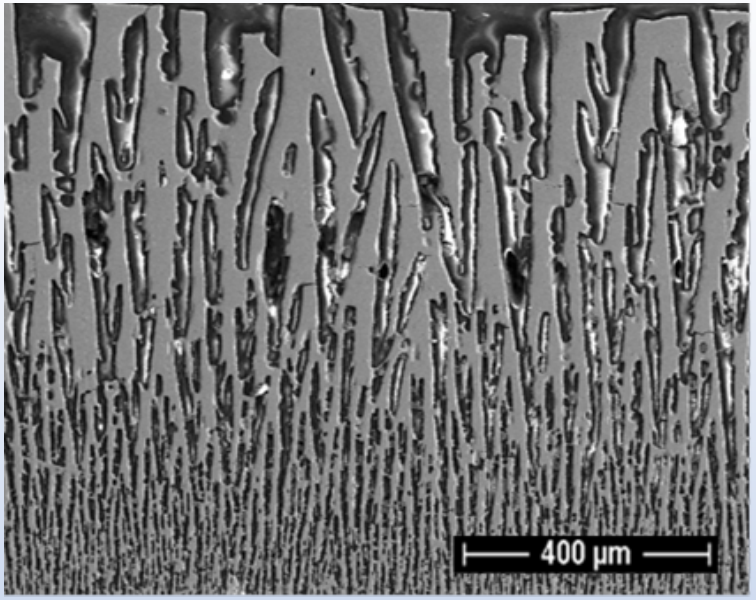
- Phase II
  - Refinement of freeze tape cast parameters with scale-up of sample size.
  - Characterization of functional enhancements with PEMFC partner.
  - Demonstration of scaled production rates.

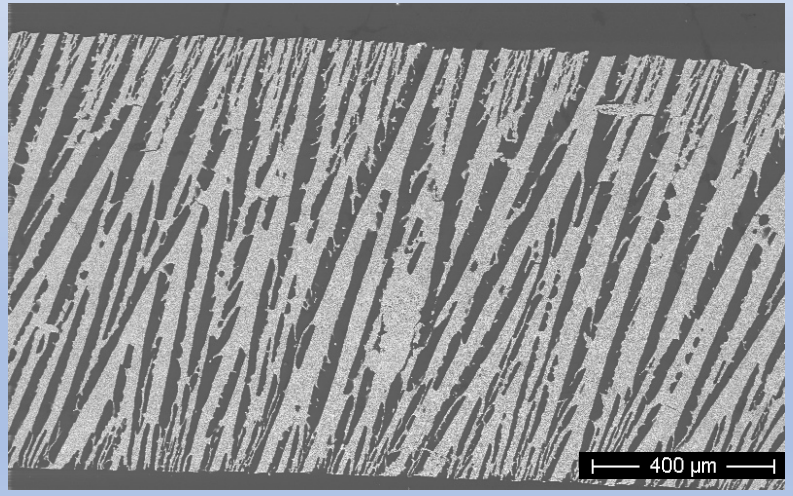
Any proposed future work is subject to change based on funding levels.

Summary

- Freeze tape casting represents a means of producing graded architectures which have been theorized, but never demonstrated, especially over large areas.

- This project uses freeze tape casting to demonstrate Ti-based GDLs with hydrophobicity gradients enabling the layer to act as a passive pump.





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