3D Structured Liquid/Gas Diffusion Layers with Flow Enhanced Microchannels for Proton Exchange Membrane Electrolyzers

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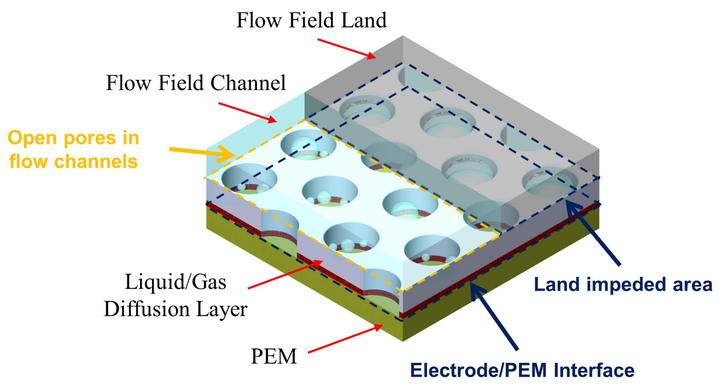
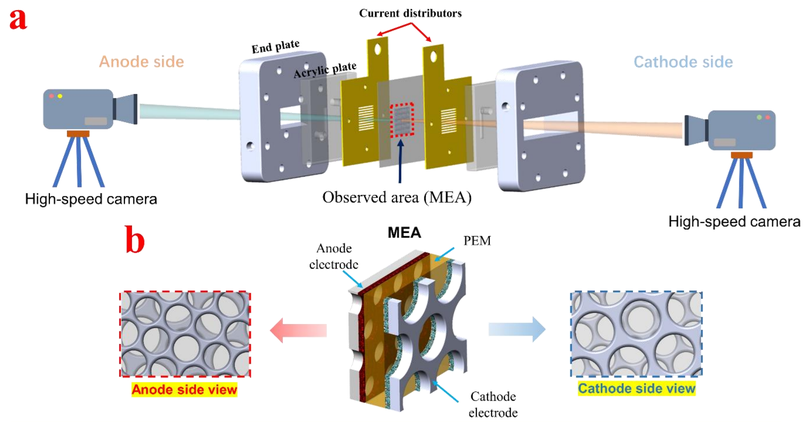
1. Background: Channel/Land Configuration in PEM Electrolyzer



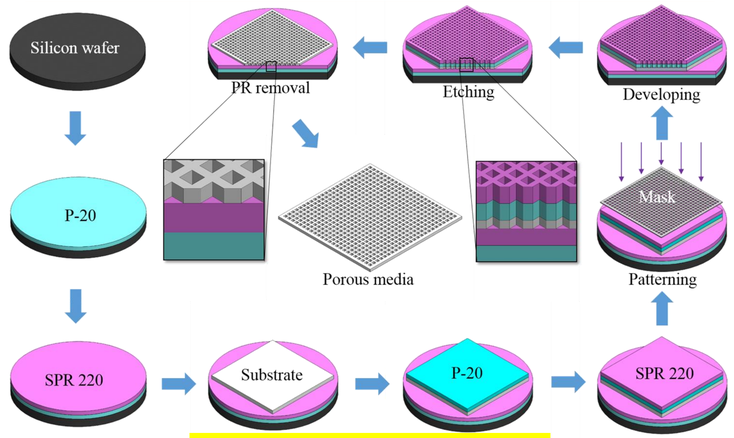
BP lands block pores

2. Visualization: Interface-visible water electrolyzer cell



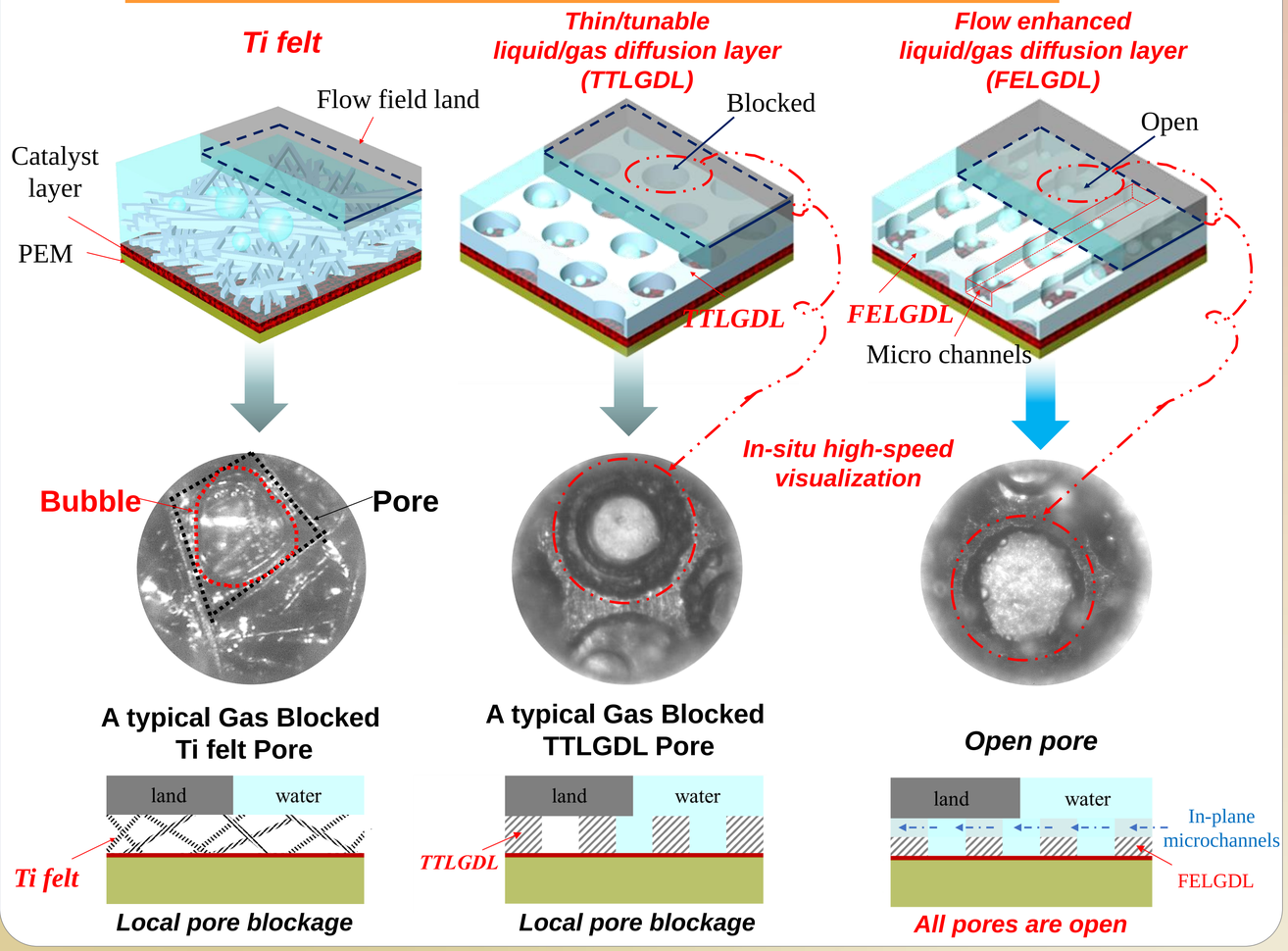
In-situ observation of Electrode/PEM interfaces

4. Method: Wet etching technique for PTL fabrication (ORNL)



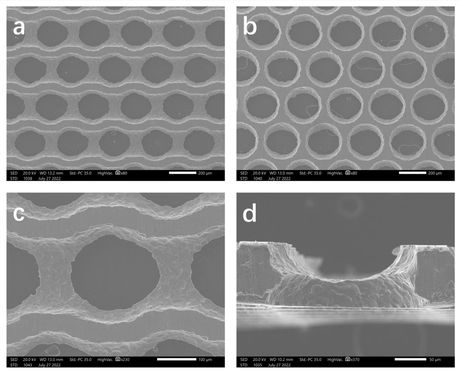
Precision fabrication

3. Unveiling mass transport issues: Bubble Blockage in Electrode/PEM interface

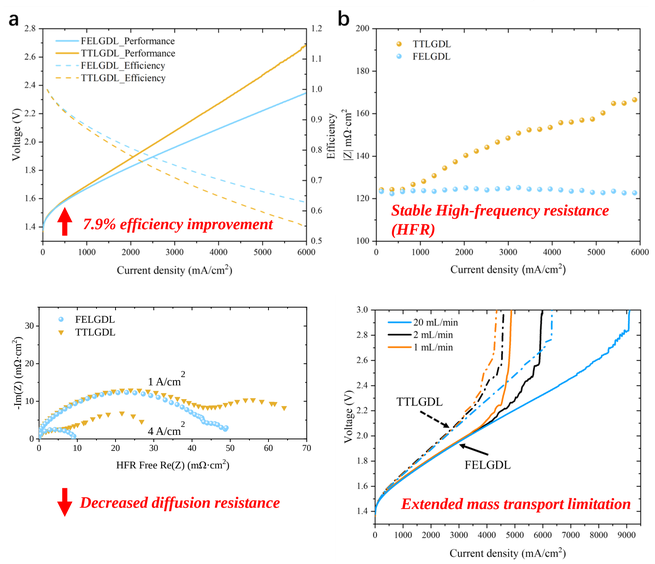


5. Results: Performance and Bubble dynamics

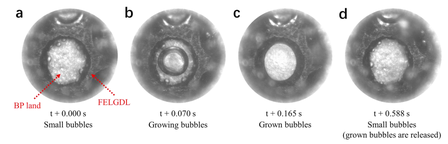
Morphology of FELGDL



Performance evaluation in PEM water electrolyzers



Periodical gas release under BP lands



Summary

- The long-term gas blockage of PTL/TTLGDL pores under BP lands is resolved by the developed flow enhanced liquid/gas diffusion layer (FELGDL).
- FELGDL achieved a hydrogen production efficiency increase of 7.9% at 6 A/cm^2.
- The mass transport limitation is extended 42.9% at 6 A/cm^2 and water flow rate of 20 mL/min.
- The produced gas can be periodically removed from the pores under BP lands.

Acknowledgements

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Reference: 1. Wang, Weitian, et al. "Discovering Reactant Supply Pathways at Electrode/PEM Reaction Interfaces Via a Tailored Interface-Visible Characterization Cell." Small (2023): 2207809.
2. Mo, Jingke, et al. "Thin liquid/gas diffusion layers for high-efficiency hydrogen production from water splitting." Applied energy 177 (2016): 817-822.