HydroGEN LTE Questionnaire

Background and motivation: We aim to develop standards for benchmarking performance, so comparisons between devices from different research groups can be made in future. In addition to device-specific optimal operating conditions, a community-accepted benchmarking tests developed through this exercise are strongly encouraged to include in publication.

* Required

1. **Email address** *

2. **Please list your name:** *

3. **Please list your affiliation:** *

What standard conditions should we use to benchmark devices for Low Temperature PEM and/or AEM water splitting?

4. **1)Do you think reporting the performance of devices at standard conditions, in addition to "favored" testing conditions, would be useful?**
   Mark only one oval.
   - Yes
   - No

5. **If no, please explain**

6. **2) Would a standardized cell hardware design be useful?**
   Mark only one oval.
   - Yes
   - No

7. **If no, please explain**

8. **3) Comments and questions that we missed regarding benchmarking conditions?**

What Standard Materials Would be the Most Useful?

Background and motivation: Working with Lab nodes, we aim to develop standard materials and/or devices that can be used to compare conditions between different labs and enable rapid prototyping.

9. **1) Would standard PEM membranes be useful for testing catalysts? If yes, which would be most useful?**
   Check all that apply.
   - [ ] Nafion N117
   - [ ] Nafion N115
   - [ ] Not Useful
   - [ ] Other:

10. **2) Would standard AEM Membranes be useful for testing catalysts? If yes, which would be most useful?**
    Mark only one oval.
    - ◯ Fumapem FAA
    - ◯ Tokuyama A-201 (not currently available)
    - ◯ Not Useful
    - ◯ Other:

11. **3) Would you find any of these catalysts useful as a standard? 3a) PEM: Hydrogen Evolution Reaction**
    Mark only one oval.
    - ◯ Pt/C (50wt% - Tanaka TEC10E50E)
    - ◯ Pt black (Johnson Matthey 183000)
    - ◯ Not Useful
    - ◯ Other:

12. **3.b) AEM: Hydrogen Evolution Reaction**
Mark only one oval.

- Pt black (Johnson Matthey 183000)
- Raney(R) Nickel
- Not Useful
- Other: _____

13. **3.c) PEM: Oxygen Evolution Reaction**
Mark only one oval.

- Ir (Johnson Matthey C2026/160000)
- IrO2 (Alfa Aesar 43396)
- Not Useful
- Other: _____

14. **3.d) AEM: Oxygen Evolution Reaction**
Mark only one oval.

- IrO2 (Alfa Aesar 43396)
- Raney (R) Nickel
- Not Useful
- Other: _____

15. **4)Would you find any of these GAs Diffusion Layers (GDL) useful as a standard? 4.a) Anode Side**
Mark only one oval.

- Carbon Paper
- Porous Titanium Screen
- Not Useful
- Other: _____

16. **4.b) Cathode Side GDL**
Mark only one oval.

- Carbon Paper
- Porous Titanium Screen
- Not Useful
- Other: _____

17. **5. Comments and questions that we missed in this topic?**

What Type of Standard Cell Hardware Would be Most Useful?

Background and motivations: We aim to identify a standard cell hardware that will facilitate rapid testing of devices. The goal would be to widely distribute these and ensure benchmarking as consistent as possible. Depending on the cost of production, we may be able to distribute these beyond the labs directly involved in this initiative.

18. **1. What cell hardware would your lab like to work with?**

Mark only one oval.

- 25cm2 cell from ISE Fraunhofer Institute https://www.ise.fraunhofer.de/content/dam/ise/en/documents/information-material/Hydrogen-Technologies/17_en_ISE_Flyer_PEM_electrolysis.pdf
- 50 cm2 cell from FuelCellStore http://www.fuelcellstore.com/hydrogen-equipment/hydrogen-production-electrolyzers/electrolyzer-hardware-test-cell-square
- 25cm2 cell from Proton OnSite

19. **Other (Please list with an appropriate reference)**

20. **2) What is the maximum price range you would be willing to pay for a standard cell? Labs participating in HydroGEN should be provided cells as part of the initiative, but we would like to gauge whether these can be produced at a price that other labs could afford (choose one):**

Mark only one oval.

- $3,000 - $5,000 (USD)
- $5,000 - $10,000
- More than $10,000

21. **Price is not the first consideration for us (please explain):**

22. **3) What is the price of the current cell your lab uses to test LTE materials and cells? Would it be useful to consider designing cells that would be a competitively priced alternative that labs outside the initiative would purchase?**

23. **4) Other hardware related topics that you would like to suggest, please list.**

Open Questions

24. **1) What are the most pressing needs/challenges for LTE water splitting?**
Mark only one oval.

- ◯ Lack of suitable abundant materials
- ◯ Device stability
- ◯ Cost per kg of H2
- ◯ Other: _____

25. **Please elaborate**

26. **2) What are the critical parameters to calculate and characterize for LTE? List parameters that should be measured during ex-situ and/or in-situ testing.**

27. **3) How can we accelerate testing of device/component stability?**

28. **4) What techniques/instruments would be the most useful for US National Labs to develop as nodes?**

Further Input

29. **1) Comments and/or questions that we missed regarding standards and benchmarking conditions?**

30. **2) Would you like to review and provide feedback on the proposed Test Framework? (If yes, you will be sent an Excel sheet to review and provide feedback)**
Mark only one oval.

- ◯ Yes
- ◯ No

A copy of your responses will be emailed to the address you provided