

## Supplementary Information

### Design and scale-up of zero-gap AEM water electrolyzers for hydrogen production

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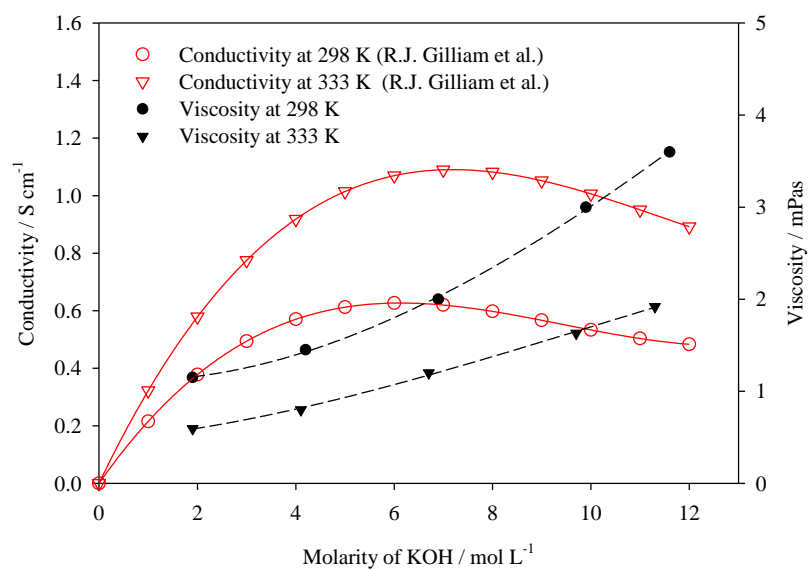
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**Table S1** Estimated exposed surface area for each flow-field plate design.

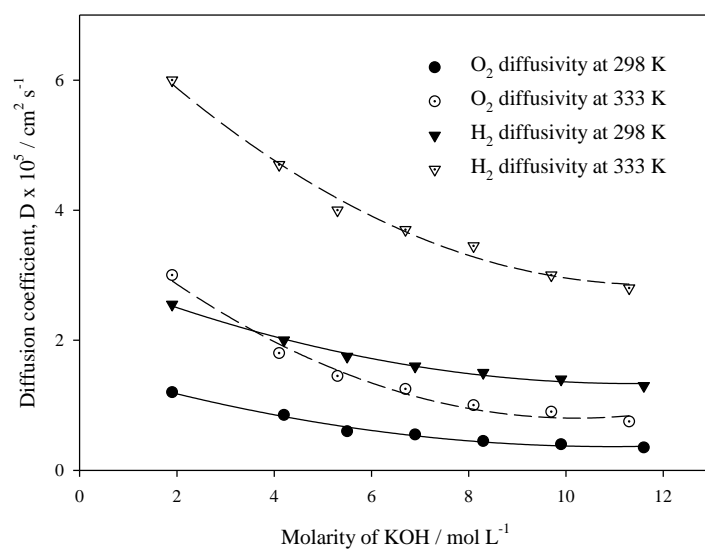
Flow field design	Parallel	Single serpentine	Double serpentine	Triple serpentine
Total exposed area (cm <sup>2</sup> )	6.8	6.4	7.0	5.7

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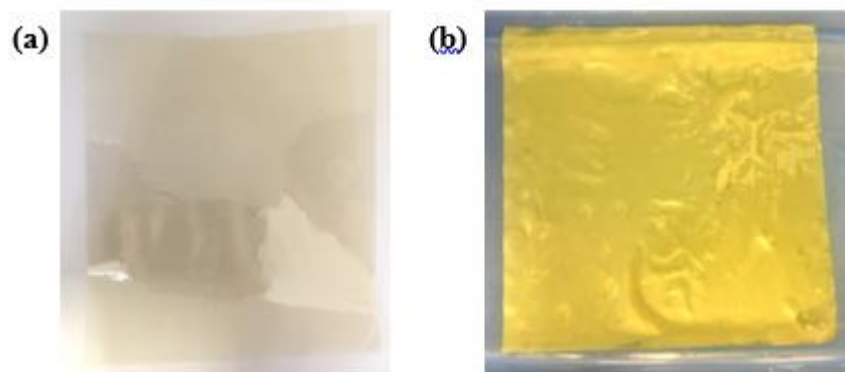
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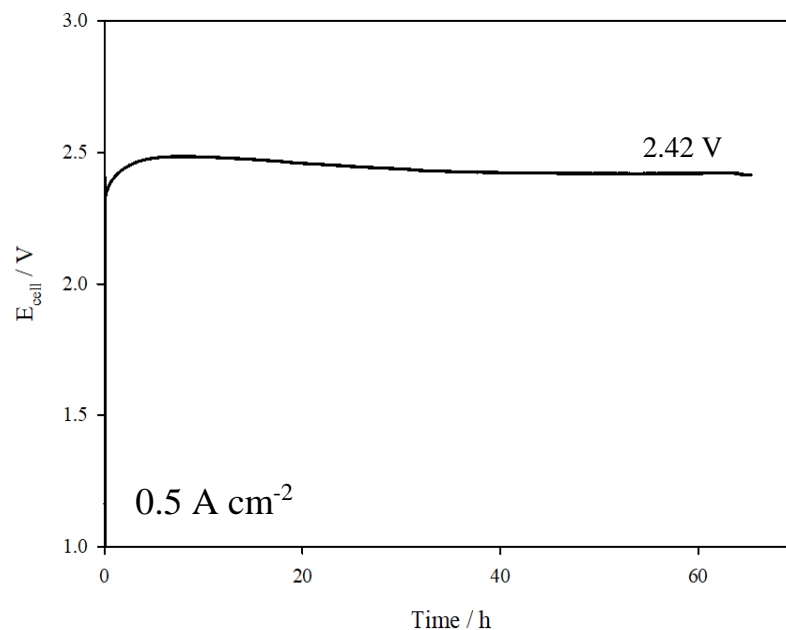
**Figure S2** Comparison of the conductivities [1] and viscosities [2] of KOH over a range of electrolyte concentrations, at 298 K and 333 K



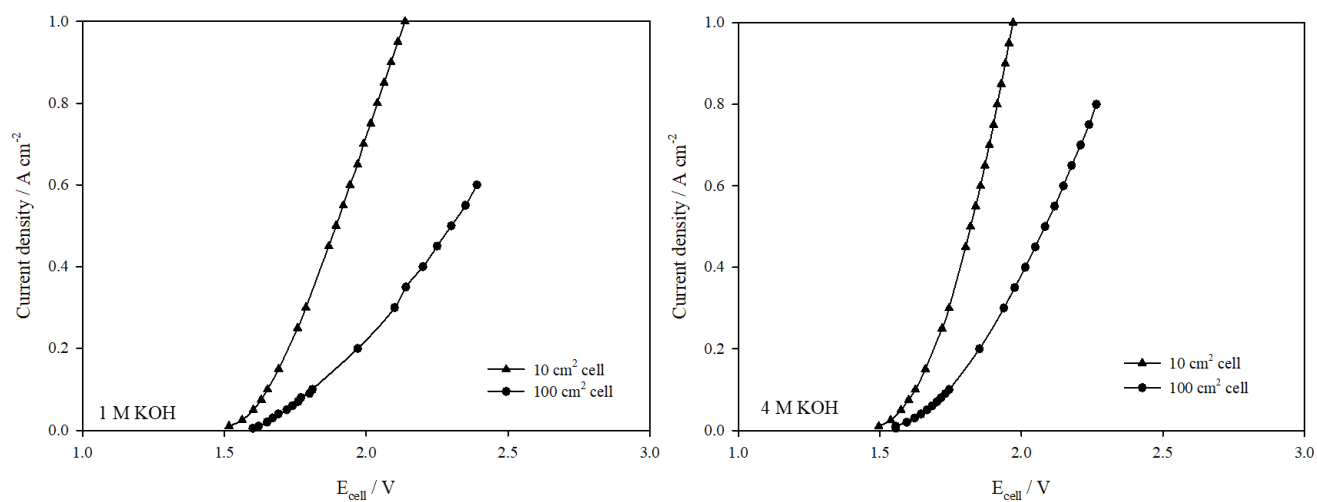
**Figure S3** Diffusion coefficients of O<sub>2</sub> and H<sub>2</sub> in KOH solutions of different molarities, at 298 K and 333 K [3].



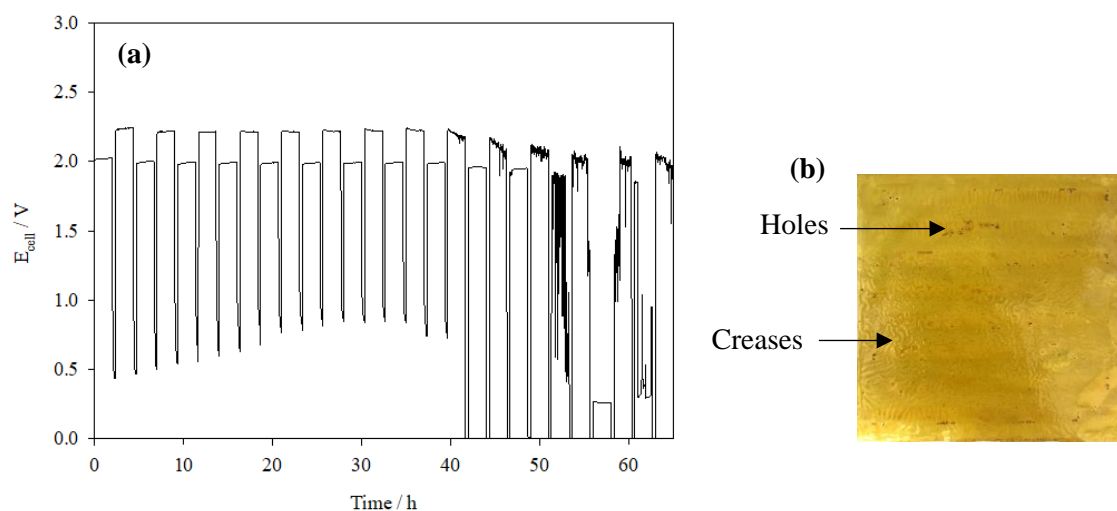
**Figure S4** **a)** Dry FAA-3-50 and **b)** FAA-3-50 after being immersed in 1 M KOH overnight.



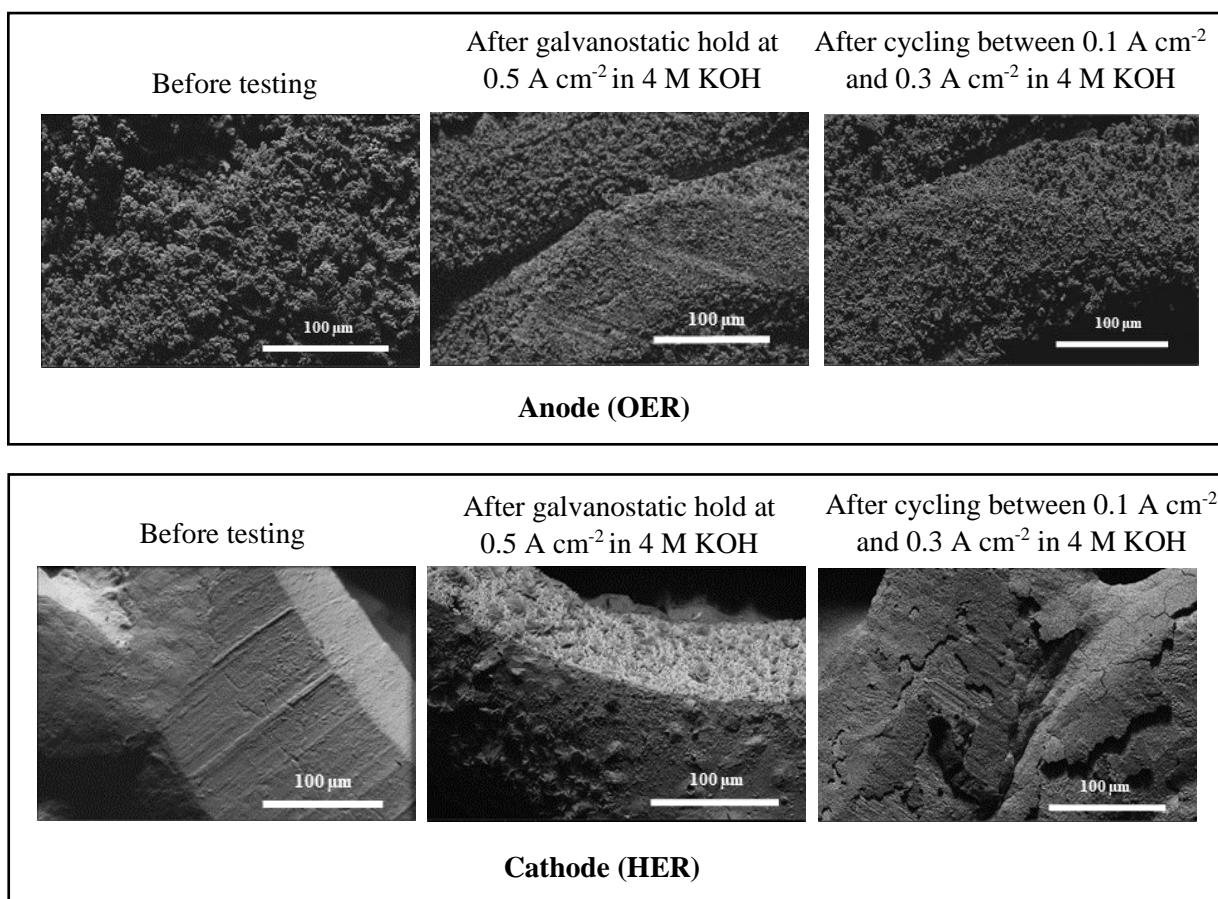
**Figure S5 a)**  $E_{\text{cell}}$  vs. time plot of  $10 \text{ cm}^2$  AEM cell assembled with uncoated Ni mesh electrodes tested in 1 M KOH at  $0.5 \text{ A cm}^{-2}$ , 323 K.



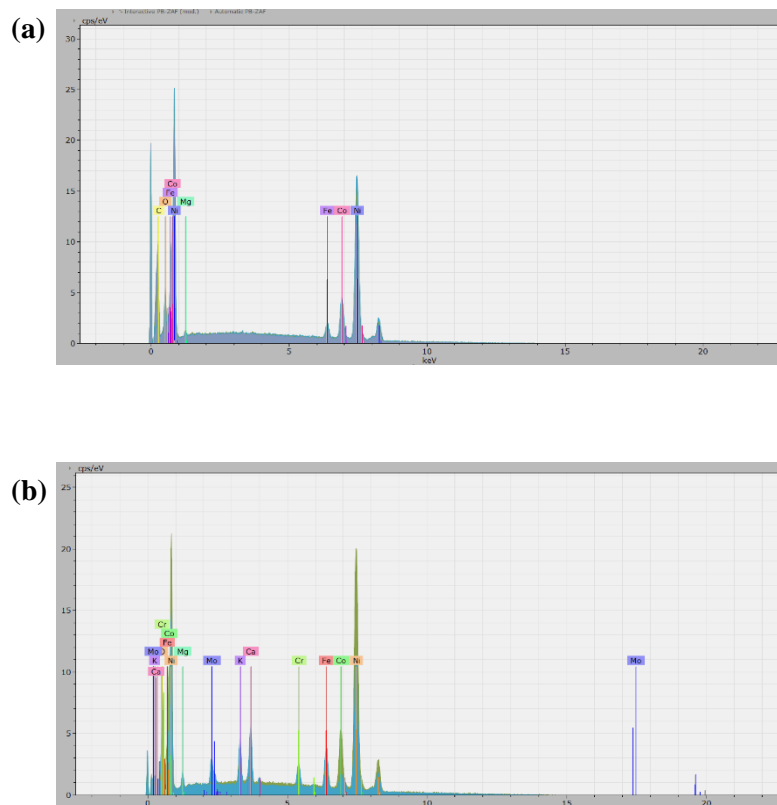
**Figure S5 b)** I-V curves of  $10 \text{ cm}^2$  cell and  $100 \text{ cm}^2$  AEM cells assembled with catalyst-coated Ni mesh tested in 1 M KOH and 4 M KOH.



**Figure S6 a)** Intermittent test cycled alternately at  $0.1 \text{ A cm}^{-2}$  and  $0.3 \text{ A cm}^{-2}$  with brief rest periods in between. The  $100 \text{ cm}^2$  cell is assembled with uncoated Ni mesh electrodes and FAA-3-50 membrane. Operating conditions: 4 M KOH, 323 K, flow rate  $1100 \text{ mL min}^{-1}$ . **b)** FAA-3-50 taken from the disassembled cell after the test.



**Figure S7** SEM images of the anode and cathode before testing, after galvanostatic holds at  $0.5 \text{ A cm}^{-2}$ , and after cycling between  $0.1 \text{ A cm}^{-2}$  and  $0.3 \text{ A cm}^{-2}$  in 4 M KOH.



**Figure S8** EDX spectrums of filtered and dried precipitate from electrolyte **a)** after galvanostatic hold at  $0.5 \text{ A cm}^{-2}$  and **b)** after dynamic load cycling between  $0.1 \text{ A cm}^{-2}$  and  $0.3 \text{ A cm}^{-2}$ .

## References

1. Gilliam, R.J.; Graydon, J.W.; Kirk, D.W.; Thorpe, S.J. A review of specific conductivities of potassium hydroxide solutions for various concentrations and temperatures. *Int. J. Hydrogen Energy* **2007**, *32*, 359-364,
2. Corporation, O.C. *Caustic Potash Handbook*; Dallas, Texas, 2018.
3. Tham, M.K.; Walker, R.D.; Gubbins, K.E. Diffusion of oxygen and hydrogen in aqueous potassium hydroxide solutions. *J. Phys. Chem.* **1970**, *74*, 1747-1751.