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Supporting Information

An Open Thermo-Electrochemical Cell Enabled by Interfacial Evaporation

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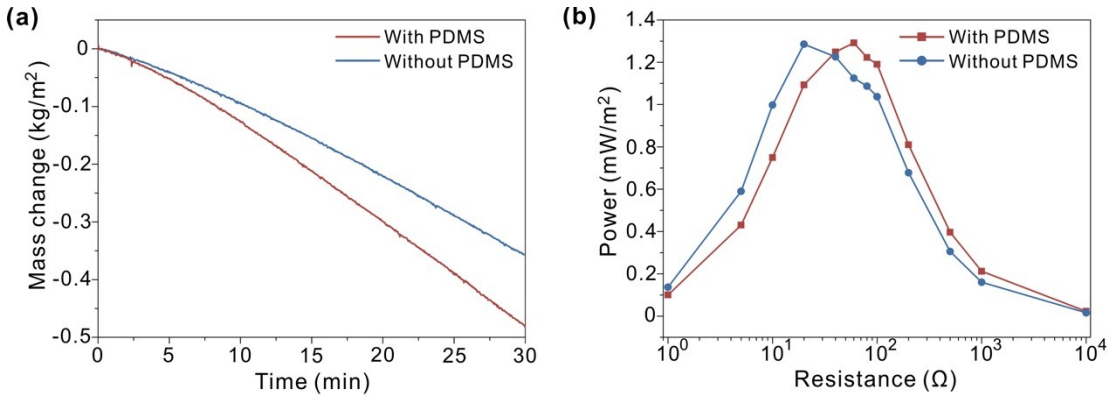

Fig. S1 Performance of the thermo-electrochemical cell (TEC) with and without the PDMS foam under one-sun illumination. TEC with DI water-based electrolyte was used in this experiment. (a) Mass change of the TEC with and without the PDMS foam. (b) Output power of the TEC with and without the PDMS foam.

We compared the performance of the TEC with and without the PDMS foam. Fig. S1a shows that the TEC without PDMS had a lower evaporation rate due to the higher downward conductive heat loss, and the calculated evaporation efficiency was only 34%, which was much less than that of the TEC with PDMS. Fig. S1b shows the output power of the TEC with and without PDMS foam. The TEC without PDMS had the similar peak output power as that of the TEC with PDMS. Although the PDMS foam reduced the effective contact area between the redox couples and the top electrode, which would result in the reduction of the output power, the temperature difference between two electrodes, on the other hand, would increase due to the decrease of the downward conductive heat loss, which would in turn increase the output power. There is thus a tradeoff between increasing the contact area between redox couples and the top electrode and decreasing the downward conductive heat loss.

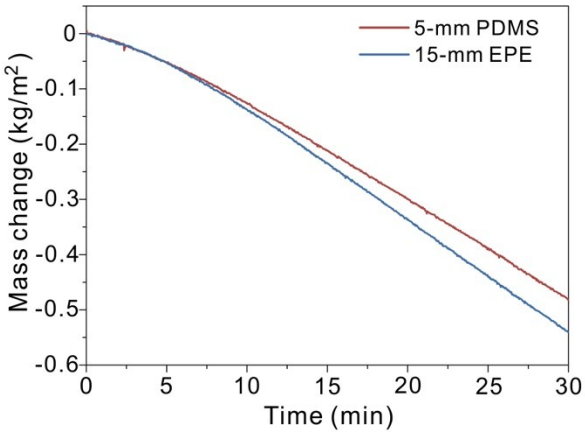

Fig. S2 Mass change of the TEC with different thermal insulators under one-sun illumination. TEC with DI water-based electrolyte was used in this experiment.

We replaced the PDMS foam, which has a thermal conductivity of ~0.09 W m^{-1} K^{-1}, with an expandable-polyethylene (EPE) foam, which has a lower thermal conductivity of ~0.03 W m^{-1} K^{-1}, to improve the thermal insulation. The EPE foam had the same top-surface area as that of the PDMS foam, and had a larger thickness than that of the PDMS foam, which could help further decrease the conductive heat loss. As shown in Fig. S2, the TEC with 15-mm EPE had a

larger evaporation rate than that of the TEC with 5-mm PDMS. The calculated evaporation efficiency was improved to 68%.

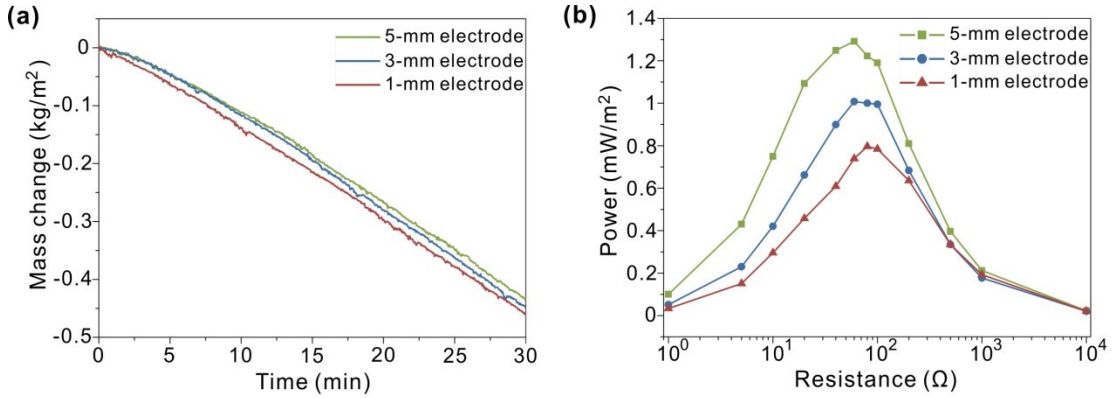

Fig. S3 Effect of the thickness of the top electrode on the performance of the TEC with DI water-based electrolyte under one-sun illumination. In this study, the thickness of the top electrode was set as 1 mm, 3 mm and 5 mm. (a) The mass change of the TEC with the decrease of the thickness of the top electrode. (b) The change of output power of the TEC with the decrease of the thickness of the top electrode.

Fig. S3 shows the effect of the thickness of the top electrode on the performance of the TEC. As shown in Figure S3a, the change of the evaporation rate of the TEC was relatively small with the decrease of the thickness of the top electrode, but there was substantial decrease of the output power of the TEC with the decrease of the thickness of the top electrode (Figure S3b). As the thickness of the top electrode decreased, the amount of reaction site for the redox reaction also decreased, which led to the decrease in the output power.

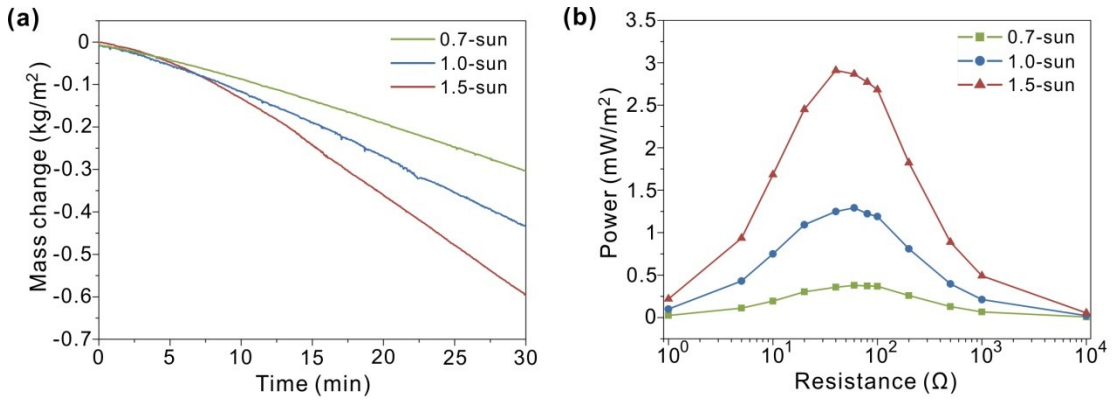

Fig. S4 Effect of the solar flux on the performance of the TEC with DI water-based electrolyte: (a) The mass change of the TEC with the increase of the solar flux. (b) The change of output power of the TEC with the increase of the solar flux.

Fig. S4 shows the effect of solar flux on the performance of the TEC. With the increasing of the solar flux, both the evaporation rate and the output power of the TEC increased.

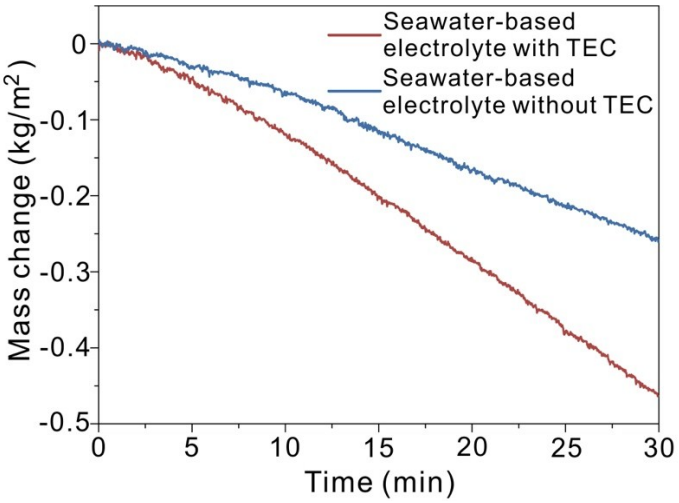

Fig. S5 Mass change of the seawater-based electrolyte with and without TEC under one-sun illumination.