Supplementary information

A Venus-flytrap-inspired pH-responsive porous membrane with internal crosslinking networks

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Fig. S1. The pictures of SPEEK-H/PBI (left) and SPEEK-Na/PBI (right) solutions in DMAc.

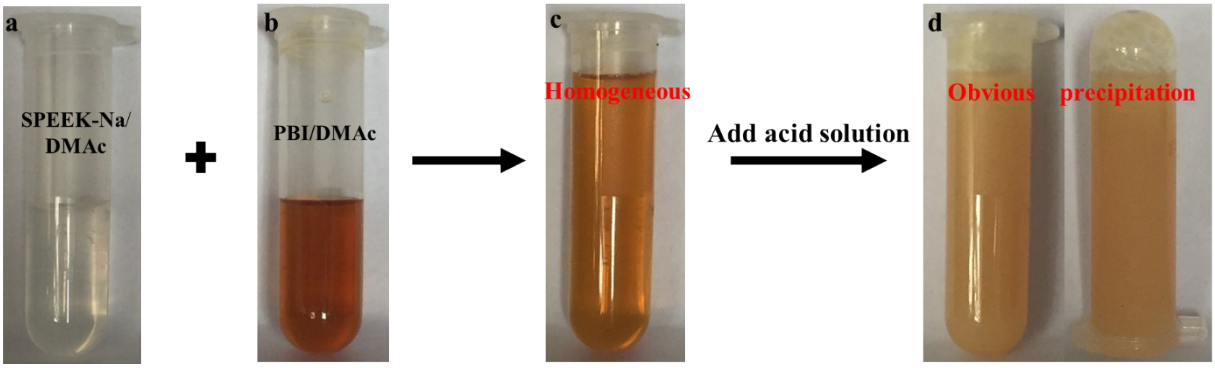

Fig. S2. Pictures to show the function of the added acid solution.

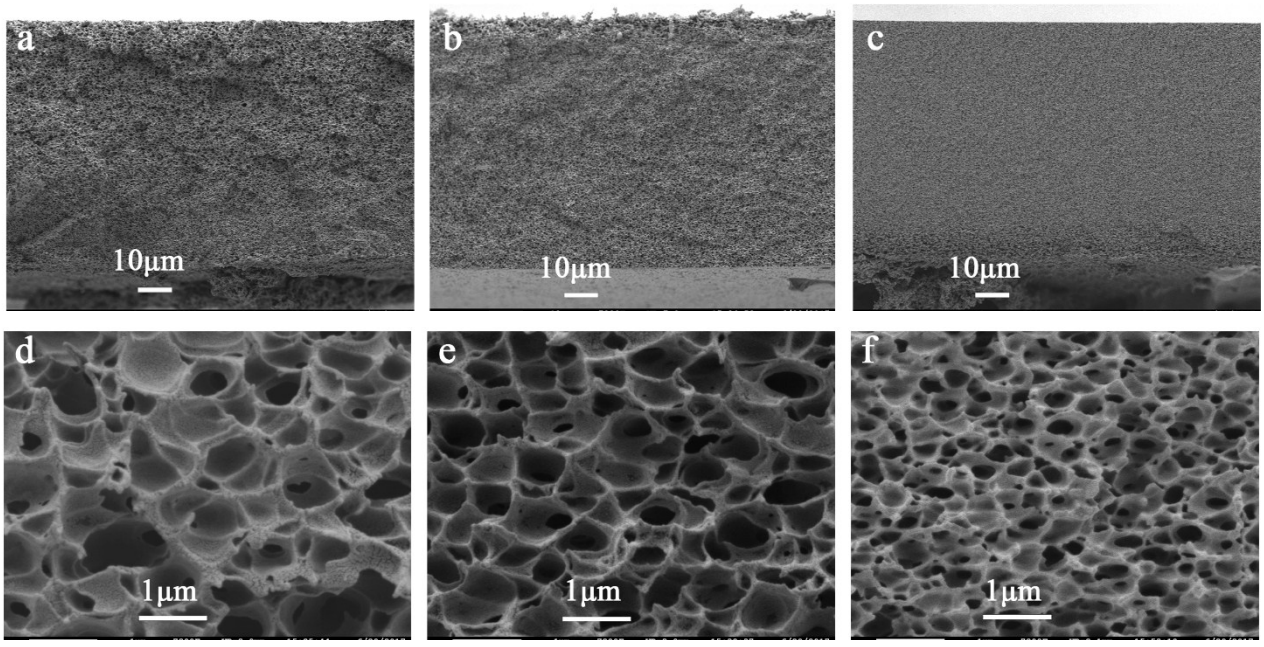

Fig. S3. The cross-sectional SEM images of a,d) M-5-Shut, b,e) M-10-Shut and c,f) M-15-Shut.

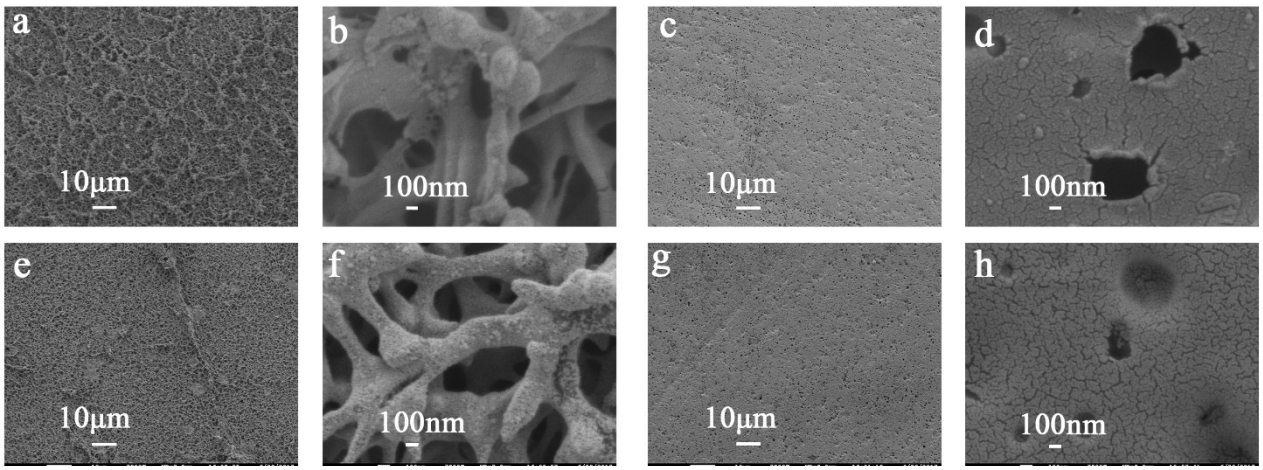

Fig. S4. The surface SEM images of a-d) M-5-Open and e-h) M-5-Shut. a,e) surface and b, f)magnified surface images upon vapor side of M-5-Open and M-5-Shut; c,g) surface and d,h) magnified surface images upon glass side of M-5-Open and M-5-Shut.

Table S1. The physicochemical properties of M-X-Shut (X=5, 10, 15) membranes.

Code	**SPEEK-Na/ (SPEEK-Na+ PBI)** （%）	**Thickness** （μm）	**Porosity** （%）	**Water uptake** （%）
M-5-Shut	5	75±5	60.16	151.09
M-10-Shut	10	75±5	60.19	171.59
M-15-Shut	15	75±5	64.96	182.15

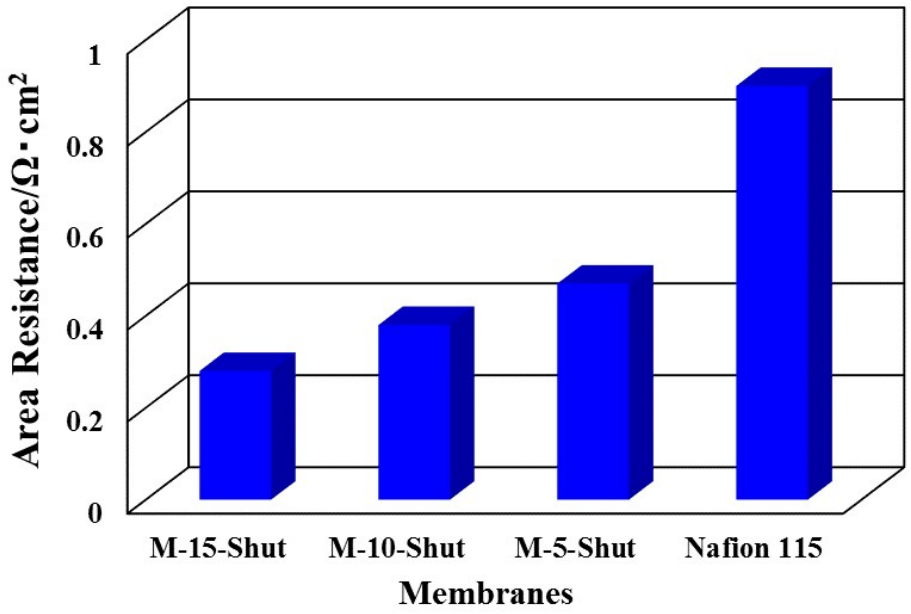

Fig. S5. Area resistance of the prepared M-X-Shut (X=5, 10, 15) and Nafion 115.

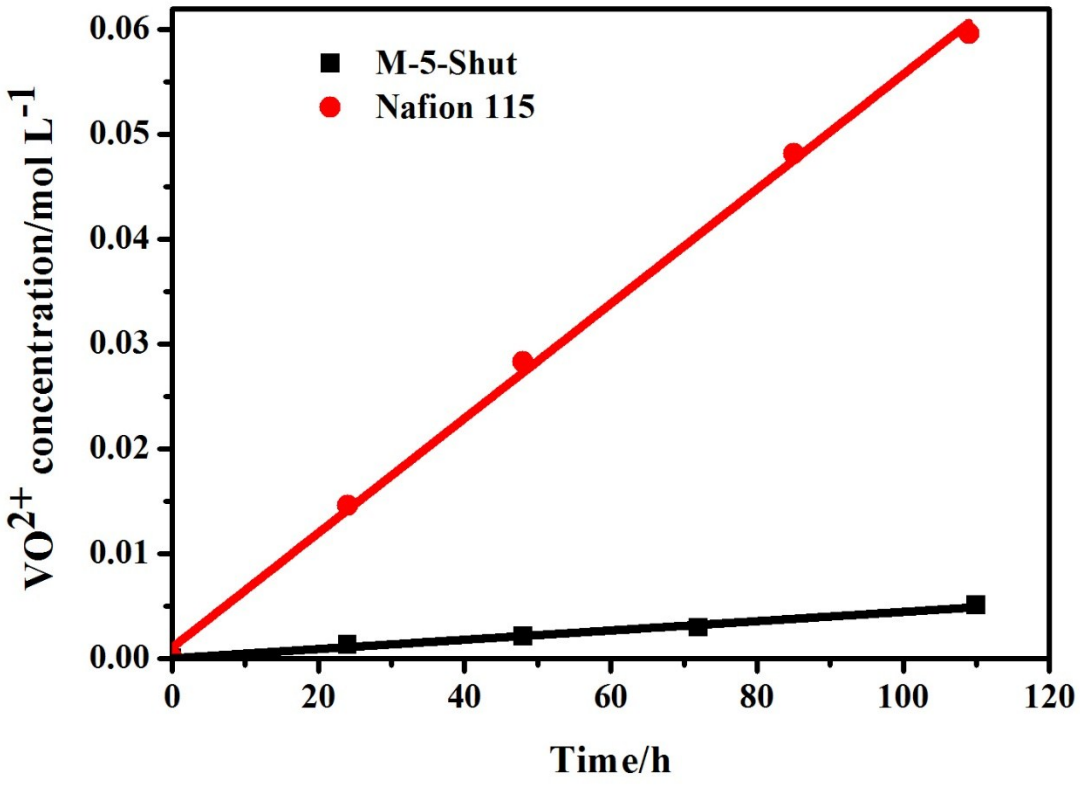

Fig. S6. Vanadium ion permeability of M-5-Shut and Nafion 115.

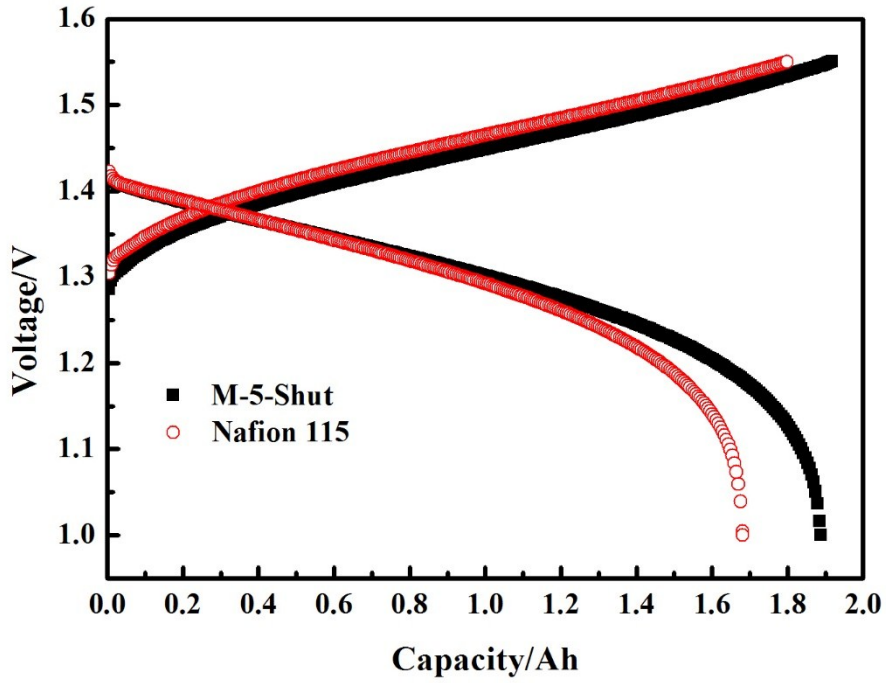

Fig. S7. The charge-discharge curves (the first cycle) of VFB with M-5-Shut and Nafion 115 membrane at 80 mA cm^{-2}.

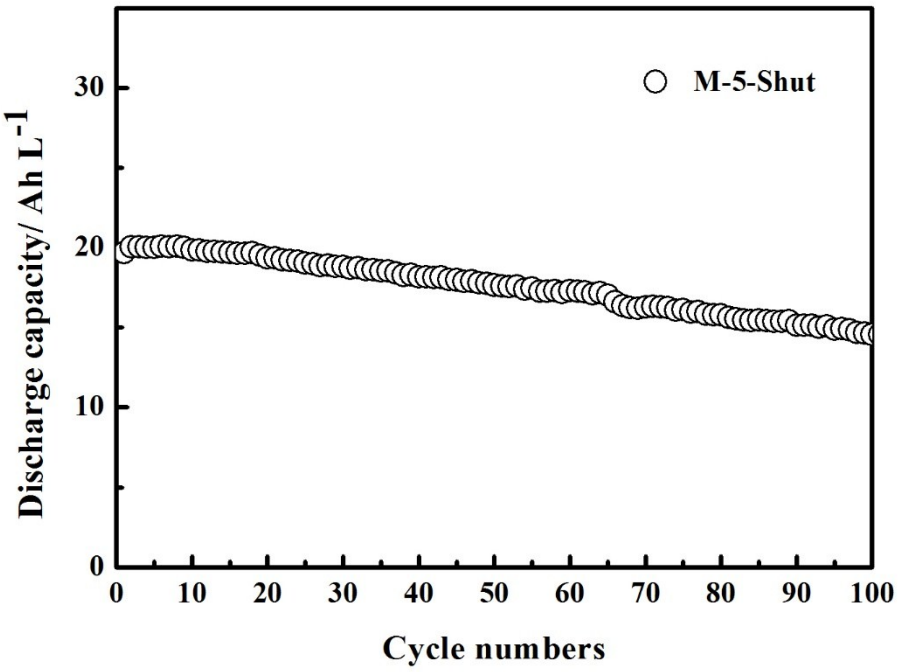

Fig. S8. Discharge capacity retention of M-5-Shut at 140 mA cm^{-2} in a VFB.

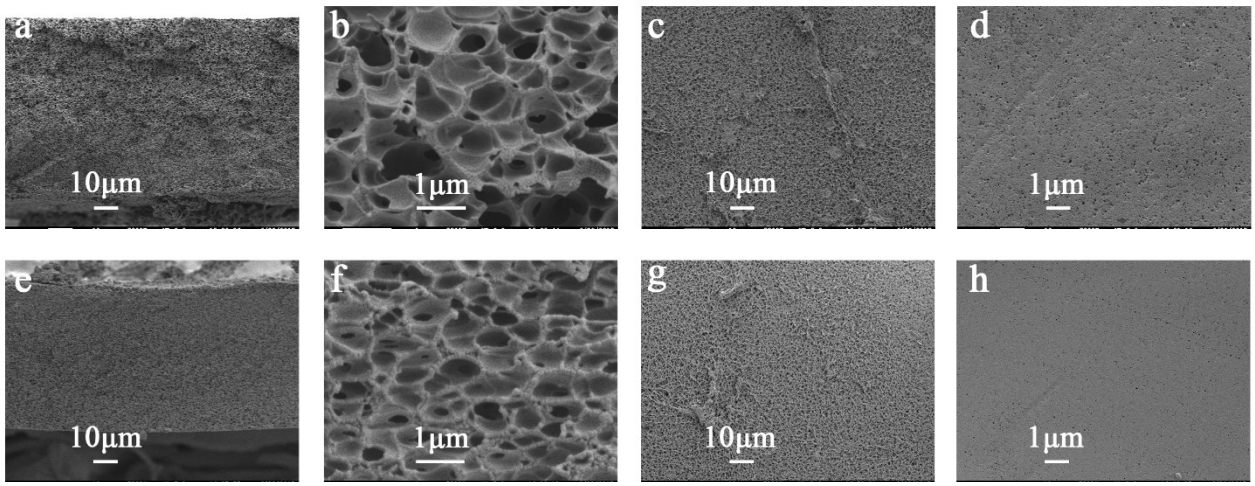

Fig. S9. The cross-sectional and surface SEM images of M-5-Shut a-d) before and e-h) after 10000 cycles. a,e) Cross-section and b,f) magnified cross-section images of before and after 10000 cycles; c,g) surface images upon vapor side of before and after 10000 cycles; d,h) surface images upon glass side of before and after 10000 cycles.

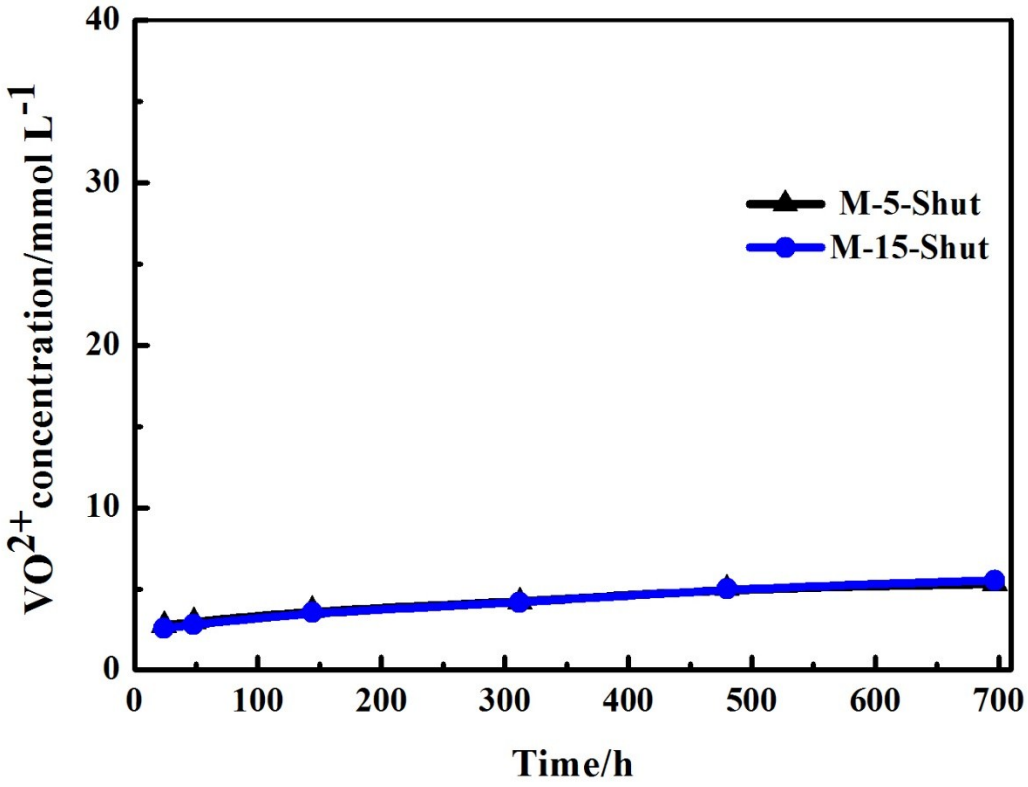

Fig. S10. The change of VO^{2+}concentration containing M-5-Shut and M-15-Shut membranes in 0.15 M VO_2^+ 3 M H_2SO_4 at 40°C versus time.